

INPUT

MARKET FORECAST

U.S. Systems Software Market

1993-1998

U.S. Market Analysis Program

O C T O B E R 1 9 9 3

U.S. SYSTEMS SOFTWARE PRODUCTS MARKET

1993-1998

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Abstract

This annual report provides an analysis and five-year forecast of the U.S. systems software products market for the period 1993-1998. The forecasts contained in this report divide the market into systems control products, applications development tools, and operations management tools. The market is also segmented into three platform categories: mainframe, minicomputer, and PC/workstation platforms.

The report considers the underlying trends and issues that impact the sale of systems software products in the information services market, and based upon these considerations, projects growth patterns for the next five years.

The report contains 94 pages and 29 exhibits.

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**Information Services Market Analysis Program
(MAP)**

***U.S. Systems Software Products Market,
1993-1998***

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Introduction

This report is one of a series of market analysis reports prepared each year by INPUT for the key segments (delivery modes) of the U.S. information services industry. These delivery modes are:

1. Professional Services
2. Systems Integration
3. Systems Operations
4. Processing Services
5. Network Services
6. Systems Software Products
7. Applications Software Products
8. Turnkey Systems
9. Equipment Services

A

Purpose and Organization

1. Purpose

This report analyzes the systems software products delivery mode of the U.S. information services industry:

- The report includes five-year forecasts, an assessment of market drivers, analysis of competitive trends, and identification of leading vendors.
- The report assesses trends and events within the U.S. economy, the U.S. information services industry, and the systems software delivery mode to provide the reader with a comprehensive foundation for understanding this market sector and for anticipating future directions.

The report provides readers with insights and information that will help them:

- Review the forces shaping the market
- Develop internal corporate financial projections
- Identify new markets and product and services opportunities
- Assess the competitive trends
- Determine potential market directions
- Assist in prioritizing investments

2. Organization

This report is organized as described in Exhibit I-1. Each delivery mode report within the Market Analysis Program follows this format. The industry and cross-industry sector reports, described below, follow a very similar format.

EXHIBIT I-1

Market Report Organization

- I. Introduction
 - Introduction and definition of the delivery mode and its substructure or segments.
- II. Executive Overview
 - Synopsis of the entire report written at the end of the year.
- III. Information Services Market Forecast
 - Presentation of the information services market forecast by delivery mode and submode.
- IV. Issues and Trends
 - An assessment of significant issues and trends in systems software markets.
- V. Competitive Environment
 - Discussion of the competitive environment for information services within the delivery mode—with vendor profiles.
- VI. Conclusions and Recommendations
 - Summary of risks and opportunities
- A. Forecast Data Base
 - A detailed forecast by delivery mode, submode, and industry/cross-industry sector. Contains a reconciliation to the previous year's Appendix B.

B

Scope and Methodology**1. Scope**

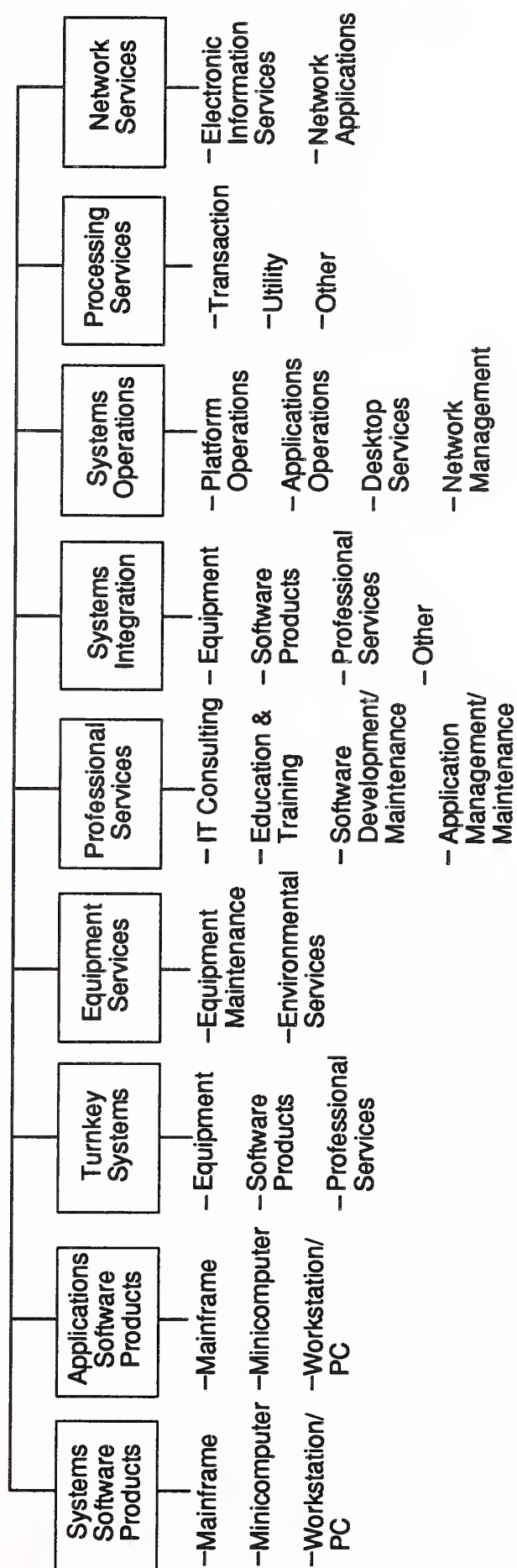
This report addresses the U.S. information services industry for the systems software sector (delivery mode). It includes user expenditures that are noncaptive and generally available to vendors. Many large organizations have portions of their information services requirements satisfied by internal divisions. The resulting expenditure is not available for competitive bid by the general vendor community and is not included in INPUT's projections. The noncaptive distinction is important and is addressed in more detail in INPUT's *Definition of Terms*.

a. Information Services Industry Structure

Exhibit I-2 defines the structure of the information services industry as used by INPUT in its market analysis and forecasts. The industry consists of nine delivery modes, each of which contains a number of submodes.

EXHIBIT I-2

Information Services Industry Structure—1993



Source: INPUT

- *Delivery modes* are specific products and services that satisfy a given user need. *Market sectors* specify who the buyer is and *Delivery modes* specify what the user is buying.
- INPUT develops a five-year forecast for the delivery mode and each of the submodes.

INPUT also publishes market sector reports analyzing 15 industry and 7 cross-industry market sectors. These reports, published annually by INPUT, analyze the information services opportunities in industry sectors such as insurance, transportation, and discrete manufacturing and in cross-industry sectors such as accounting, human resources, and office systems.

The relationship between delivery mode forecasts and market sector forecasts is shown in Exhibit I-3.

EXHIBIT I-3

Delivery Mode versus Market Sector Forecast Content

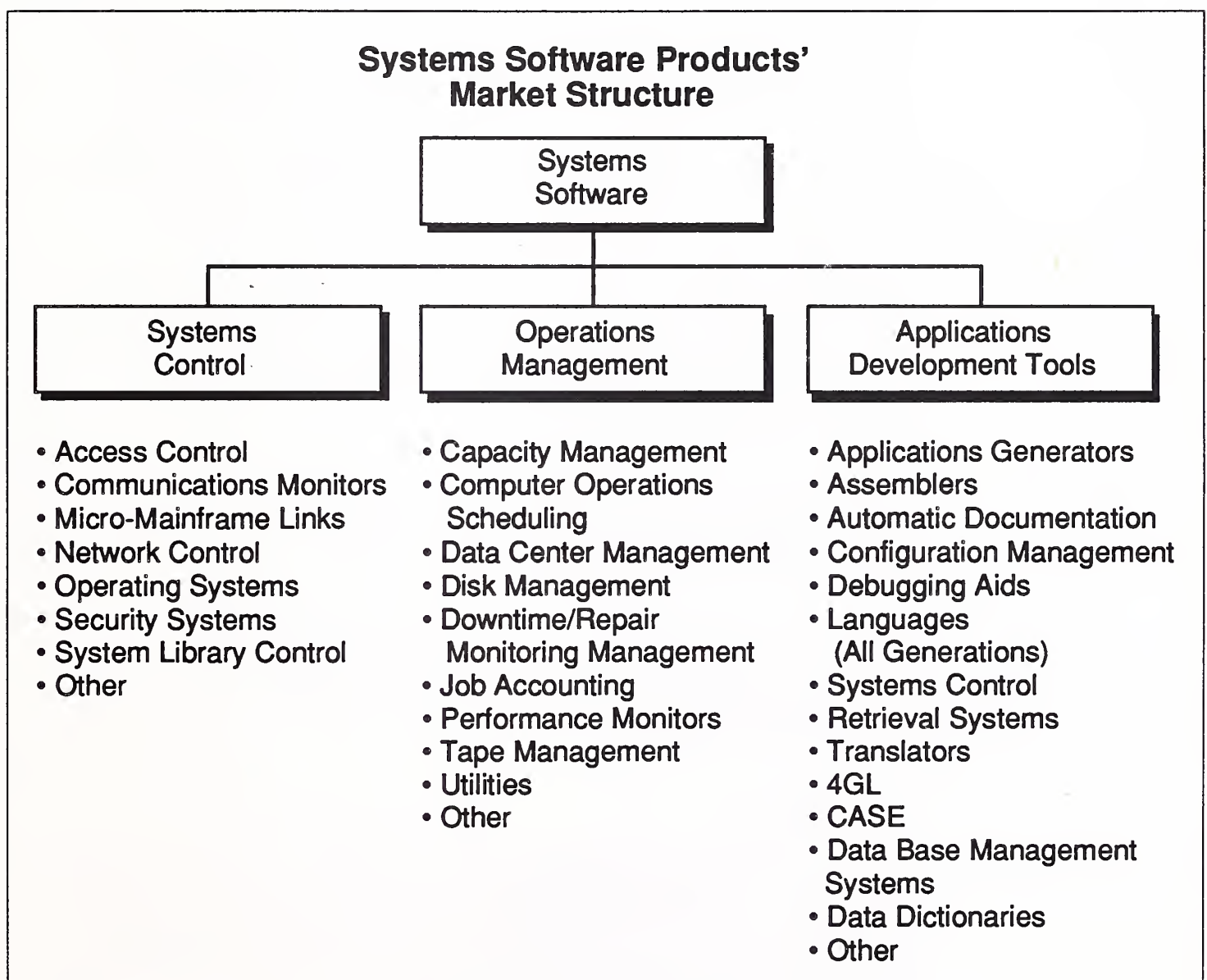
Delivery Mode	Submode	Market Sectors		
		Industry Sectors	Cross-Industry Sectors	Other
Processing Services	Transaction Utility Other	X	X	X X
Turnkey Systems		X	X	
Applications Software Products		X	X	
Systems Operations	Platform Applications	X X		
Systems Integration		X		
Professional Services		X		
Network Services	Network Applications Electronic Information Services	X X		X
Systems Software Products				X
Equipment Services	Equipment Maint. Environmental Services			X

For a more complete discussion of INPUT's information services industry structure and market sector definitions, please refer to INPUT's *Definition of Terms*.

b. Delivery Mode Description

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. The systems software products delivery mode, as shown in Exhibit I-4, is composed of the systems control products, operations management tools, and applications development tools submodes.

EXHIBIT I-4



The attributes of each submode are described below:

- *Systems Control Products* - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.
- *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk-management utilities, and capacity management.
- *Applications Development Tools* - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base systems, case tools and other development productivity aids. Also included are system utilities (e.g., sorts) that are directly invoked by an applications program.

Systems software involves user purchases of software packages for in-house computer systems. Lease and purchase expenditures are included, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's site. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included.

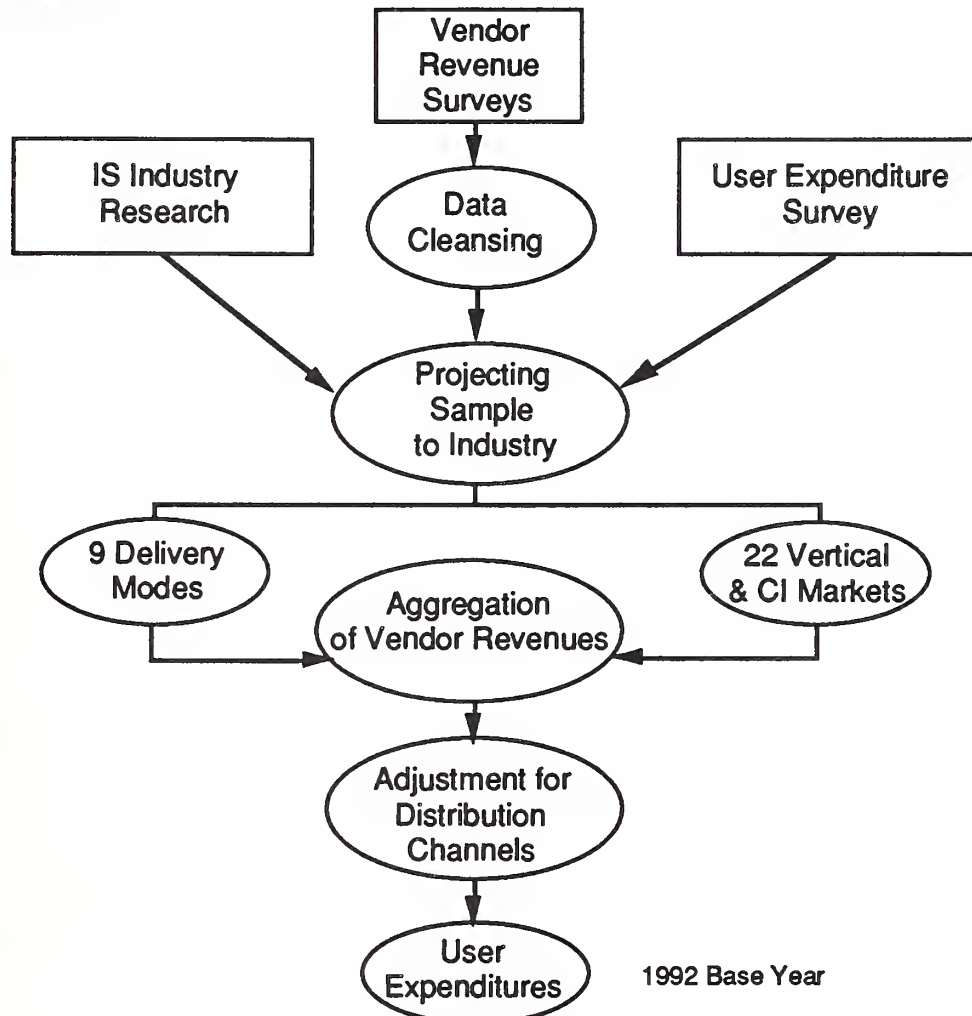
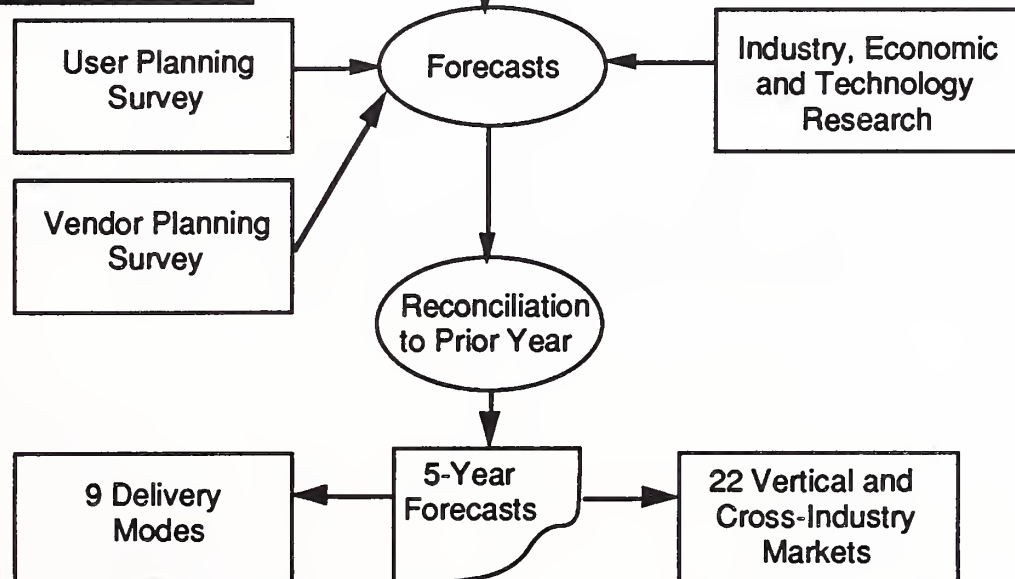
Systems software that is sold as part of other delivery modes' turnkey systems, professional services, systems operations, and systems integration is not included with systems software purchases, but is considered with each of these other delivery modes.

Systems software products are not specialized by industry. Thus, the forecasts for the systems software products delivery mode and its submodes are provided in total rather than separately for each of the industry or cross-industry sectors.

2. Methodology

INPUT's methodology for market analysis and forecasting is summarized in Exhibit I-5. As in past years, INPUT has continued to survey information services vendors to determine their U.S. information services revenues, and to query information systems organizations about expenditures and outside services acquisition plans.

EXHIBIT I-5

INPUT Research MethodologyI. Base YearII. Market Forecasts

INPUT's annual forecasting process is broken into two major parts: base-year expenditure calculations and market forecasts. Each is briefly described below.

a. Base-Year Expenditure Calculations

- INPUT determines previous-year information services revenues for the 9 delivery modes and 22 industry and cross-industry sectors for hundreds of vendors. Estimates rely upon interviews, public data, and INPUT's own estimates.
- The initial data are projected to represent the entire information services industry.
- Adjustments are made to eliminate duplications due to distribution channel overlap and to assure that captive information services expenditures are not included.
- The result is a base-year (1992) user expenditure for each of the 22 vertical and cross-industry sectors and the 9 delivery modes.

b. Market Forecasts

- In the forecasting step, INPUT surveys information systems executives to determine their projected expenditure levels, both in aggregate and for each of the outside information services categories.
- The result is a five-year forecast for each of the 22 vertical and cross-industry sectors and the 9 delivery modes. The delivery mode and market sector forecasts are correlated according to the diagram in Exhibit I-3.

To complete the process, INPUT reconciles its new forecasts with those from the previous year. Differences due to market restructuring and other factors are explained. One may use these projections to track INPUT's forecasts from year to year.

INPUT forecasts are presented in current dollars (i.e., 1998 market sizes are in 1998 dollars, including inflationary forecasts). In developing the five-year forecasts, INPUT has incorporated economic assumptions for the U.S. economy as a whole.

The GDP and GDP Deflator growth rates used in INPUT's market projections for 1993 through 1998 are from the CONSENSUSTM forecast, a product of Blue Chip Economic Indicators of Sedona, Arizona. The Blue Chip CONSENSUS forecast is derived from a leading panel of economists representing leading financial, industrial, and research firms across the U.S. and has an impressive track record of balanced and accurate projections.

The 1993-1998 assumptions are contained in Chapter III, Systems Software Market Size and forecast.

C

Related Reports

Related reports of interest to the reader are:

1. U.S. Markets

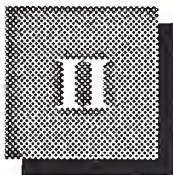
- *U.S. Applications Solutions Market Analysis Report, 1993-1998*
- *U.S. Processing Services Market Analysis Report, 1993-1998*
- *U.S. Professional Services Market Analysis Report, 1993-1998*
- *U.S. Systems Integration Market Analysis Report, 1993-1998*
- *U.S. Systems Operations Market Analysis Report, 1993-1998*
- *U.S. Industry Sector Markets, 1993-1998* (15 reports on all major industry sectors e.g., insurance, banking and finance)
- *U.S. Cross-Industry Sector Markets, 1993-1998* (7 reports on information services markets that serve all vertical industry sectors e.g., accounting)

2. European Markets

- *The Western European Market for Computer Software and Services, 1993-1998*
- *Systems Software Products Western Europe, 1993-1998*
- *Trends in Processing Services Western Europe, 1993-1998*
- *Systems Integration Market Forecast Western Europe, 1993-1998*
- *Systems Operations Market Forecast Western Europe, 1993-1998*
- *Western European Network Services Markets, 1993-1998*

The European markets are also analyzed on a vertical basis for discrete and process manufacturing, insurance, banking and finance, and retail and wholesale distribution.

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Executive Overview

Systems software encompasses systems control products, operations management, and applications development tools.

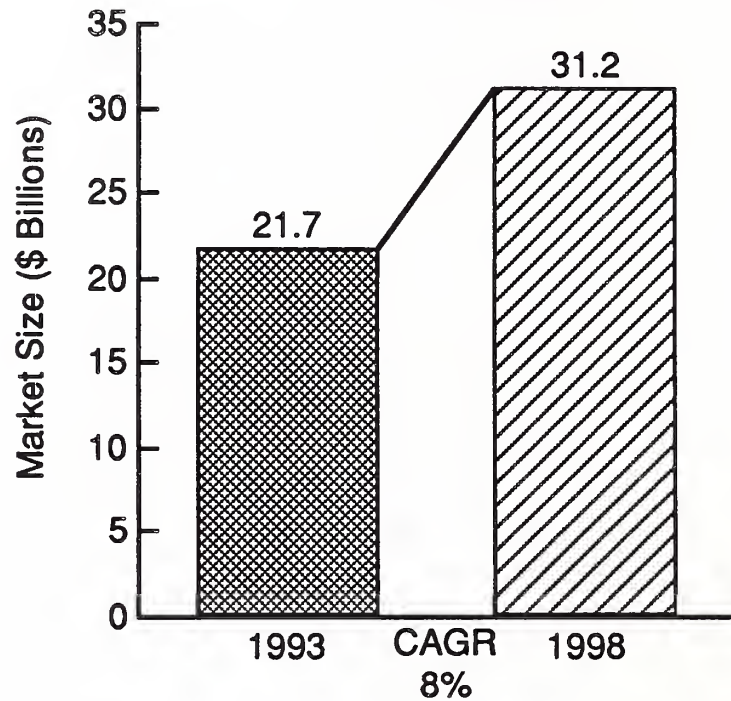
In this Executive Overview, INPUT provides a summary of trends and issues impacting both information systems users and vendors which will shape the demand for particular systems software products over the next several years. The overview also presents overall growth projections for systems software products and draws conclusions and makes recommendations about product and marketing strategies which should be considered by systems software vendors.

A

Systems Software Market Size and User Expenditures

As noted in Exhibit II-1, the overall systems software product market will grow from \$21.7 billion in 1993 to \$31.2 billion in 1998, at a CAGR of 8%.

EXHIBIT II-1

U.S. Systems Software Market, 1992-1998

This projection reflects a substantial lowering in growth rate expectations from INPUT's projection in 1992 of a 14% CAGR for the systems software market for the following five-year period.

The downward shift in growth expectations primarily reflects expectations for intense price competition, particularly in the systems control product areas, as users migrate to lower-cost platforms and demand rises for lower-cost, open systems products.

The fastest-growing submodes will be applications development tools and operations management tools. Demand for more applications development efficiency and for more innovative, cross-platform development tools to provide solutions for multi-platform, multi-vendor, and network integrations will fuel this growth.

UNIX's share of the total operating systems software market (currently estimated at 17%), is anticipated to expand to at least a 26% share by 1998, roughly the same as the market share expectation for the Windows NT enterprise-wide solution in 1998. For systems software products companies, the battle for enterprise-wide operating system market dominance is crucial. It is expected that there will be much more unity on

enterprise-wide operating systems over the next few years. Systems software developers must incorporate, at least initially, cross-platform application development tool technology into their product portfolios to be long-term major players in the systems software products and services markets.

The major long-term market opportunity is customized applications development and implementation. This services market represents a much larger market opportunity than does systems software. Eventually, the two markets will continue to blur, as companies with strong application development tool technology are expected to dominate the applications development market. This could happen at the expense of applications software products vendors unless the two software products groups engage heavily in strategic partnering.

B

Trends and Issues

Exhibit II-2 outlines key trends and issues affecting the information technology industry.

EXHIBIT II-2

Systems Software Products - Key Trends and Issues

- Rightsizing
- Open systems
- Distributed processing complexities
- Object-oriented technology solutions for heterogeneous environments
- Windows NT, NetWare and UNIX—competition for enterprisewide de facto standards
- Licensing and pricing

Rightsizing - INPUT's information systems (IS) model for the 1990s calls for movement away from centralized processing toward client/server systems and eventually toward an enterprise-wide, peer-to-peer, distributed processing environment. Eventually, any platform will be able to function as a client or server. Applications and the tools to manage them

will also be distributed across the network and provide integrated, centralized, and decentralized operations management functionality. Departmental applications and products will typically reside on minicomputers and workstations, with PCs and workstations at the desktop.

The upsizing trend to departmental-based client/server computing appears to be proceeding much more rapidly than has the downsizing movement off the mainframe. This is partially attributed to the complexities of migrating applications from a mainframe to smaller, less complex computers. In particular, systems management, data integrity, and other security issues have been retardant factors.

Revenue growth from new mainframe sales, however, has slowed significantly for all manufacturers, but a small number of mainframe vendors indicate that the annual growth rate in number of mainframe MIPS shipped has expanded at the double-digit rate over the past year. This reflects the impact of a steady decline in cost per MIPS on mainframe class machines. Some recent benchmarks indicate mainframe pricing to be in the \$40,000-\$60,000 per MIPS range, which probably reflects a combination of competitive pricing of minicomputers and lower mainframe manufacturing costs.

Eventually the terminology for mainframes and minicomputers will probably merge, but these more complex computer architectures will continue to have a significant role for corporate-wide archival storage, central administration of distributed computing solutions, and centralized applications and data base servers. In a world of peer-to-peer processing the larger computers, which will most likely evolve more toward massively parallel and SMP architectures, will probably be used for many mission-critical OLTP (On-Line Transaction Processing) data base applications.

Large mainframe-type computers will continue to be an important computer architecture, but will reflect lower-cost architectures and more competitive pricing. The biggest adjustment for systems software vendors will be how to retain an account for solutions traditionally sold on the mainframe, which will probably be decentralized in the future across multiple platforms.

For example, much of the operations management functionality for corporate IS has remained on the mainframe. It is important that vendors of operations/systems software management migrate their solutions to smaller platforms in order to retain their customer base, as well as to continue revenue growth and maintain or improve profitability.

In addition, many systems software and computer systems vendors possess the leading edge application development tools and data base management systems (DBMS) to capture additional business from their customer bases by assisting in the development and implementation of corporate data processing migration strategies. In particular, customized application development could play a much bigger role than either in-house developed or standardized software product solutions.

In addition, there are very few standardized client/server or enterprise-wide applications software solutions on the market. This provides a major opportunity for those vendors who can fill the void with appropriate solutions.

Open Systems - "Open systems" can be defined in a number of ways. Portability and inter-operability of applications are frequently mentioned as defining elements.

It would appear that the era of open systems is finally becoming a reality. Factors that have pushed it include the Microsoft NT versus UNIX vendors competitive issue, as well as the perception on the part of users that vendor support of open systems is an important element in achieving cost reductions while rightsizing data processing functions.

Open systems consensus appears to be gaining the most momentum within the UNIX community, with the last of two major divisions (OSF and USL) coming together under the COSE initiative.

Distributed Processing Complexities - For the most part, the distributed processing elements in client/server computing today don't address the complexities of inter-departmental, enterprise-wide distributed computing. This requires much more consensus on a vast complexity of de facto and de jure standards than exists today. Much of the data base technology installed today is used for decision support, not for mission-critical, OLTP solutions.

Much more consensus on a variety of distributed processing architectures and standards will be required to really drive the relational data base market for production level, OLTP solutions.

Object-Oriented Technology - The ultimate solutions for distributed processing and for improving the productivity of software application development and usage are likely to come from the object programming paradigm. From an initial major entry into GUI programming, object technology is now spreading into nearly all areas of software product development. The complexity of object-oriented technology standards issues could retard the introduction process, so it is important for vendors to participate in the work of object-oriented standards groups.

Windows NT, NetWare, and UNIX - The issue of the year is the battle of the operating systems vendors for market share leadership in enterprise-wide computing. The outlook of such battles reflects a number of factors, such as quality and cost of product, customer demand, and the way the open systems movement develops. It will be especially difficult to displace Microsoft's major dominance at the desktop.

It is too soon after the early release of Windows NT to determine which of the contenders will be the most successful. Ultimately, the real battle may be between Microsoft's object-oriented Cairo operating system and other object-oriented solutions such as Taligent or an object-layered version of UNIX.

Licensing - There has been considerable pressure to change traditional software product licensing practices from users migrating to lower-cost platforms or to outsourcing solutions. As a result, the established tiered pricing model seems to be passing in favor of user-priced, enterprise-wide, and other types of more flexible pricing models. At present, this is also creating a great deal of user confusion in determining the best product alternatives. Licensing is a particularly important issue for systems software vendors in maintaining long-term, revenue-producing relationships with their customers.

Pricing - Software pricing, which held up for many years when hardware pricing did not, has come down, particularly at the PC level. One important impact of the Windows NT, NetWare and UNIX contest is that operating systems prices could significantly soften. One particular contributing factor could be the bundling of operating systems software with more and more hardware systems, and the eventual inclusion of operating systems embedded in firmware in more computer systems. This means that systems software companies deriving an important component of their revenues from operating systems software will have to look to other types of systems software and to professional services and systems integration for growth and better margins.

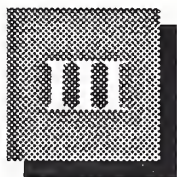
C**Conclusions and Recommendations**

Exhibit II - 3 summarizes the major conclusions and recommendations of this report for systems software vendors.

EXHIBIT II-3**Conclusions and Recommendations**

- Operating systems software will become more of a commodity
- Computer systems vendors should enhance operating system products with value-added software and services to maintain revenue growth and profitability
- A major market opportunity exists for systems software companies in supplementing the corporate in-house application development effort
- Application development tools, incorporating object-oriented technology will be key to long-term success
- Support for open systems, and partnering to provide complementary solutions for open systems vendors, will become increasingly important. Customers increasingly will require products based on open systems platforms
- Industry consolidation will occur as systems software profitability declines and the markets continue to mature. Annual growth rates are significantly lower now than only two years ago
- Partnering to provide total solutions capabilities—one-stop shopping and support will be key to vendor survival
- Software products providers should look to reselling through larger systems software and computer systems vendors, to better invest scarce resources in development activity

Blank



Systems Software Market Size and Forecast

A

Market Forecasts

1. Systems Software Market, 1993-1998

a. Definition of Systems Software Market

INPUT divides the software market into two principal categories—applications and systems software markets—and then further divides both these market segments by hardware platform. The applications software market (which is analyzed in a separate report) is further sub-divided into fifteen industry-specific and seven cross-industry market segments by hardware platform.

The systems software market is analyzed by the following subsegments: Systems Control, Operations Management, Applications Development Tools, and also by hardware platform. Each of these subsegments is defined by particular product groups in Exhibit I-4 of this report.

b. Systems Software Market Growth, 1991-1992

The actual market for systems software products grew 11% in 1992, reaching \$19.8 billion. These 1992 expenditures were in line with the 11% growth forecasted in INPUT's 1992 report. Systems control products was the one subsegment which came in below forecast, at 5% actual growth compared to a 10% forecast. This reflected slower than anticipated mainframe platform shipments as well as pricing weakness, reflecting the competition from open systems products and downsized hardware platforms.

Operations management products' growth of 13% exceeded the 11% forecast. Application development tools' growth, at 13%, was in line with the earlier forecast.

- During 1992, the fastest growing systems software product areas were the operations management tools sub-sector (including programs to manage network resources, system resources, and personnel) and application development tools. Operations management tools represented 25% of the total systems software market in 1992, and application development tools represented 41%.
- There was unexpectedly strong growth in 1991-1992 within the mainframe-based operations management system software market, as companies were seeking to increase the efficiency of existing mainframe applications and to improve the productivity of personnel at centralized data center sites. This further reflects the impact of a slow-growth period in the general economy, with the desire to defer further mainframe purchases until decisions could be made about migration of current mainframe applications to lower-cost platforms.
- Applications development tools, especially RDBMS (relational data base management system) and 4GL tools, also experienced strong growth in 1992. However, the CASE (computer-aided systems engineering) market (at an estimated \$1.5 billion) was relatively flat. The development of client/server, networked solutions is driving the RDBMS and 4GL tools markets. CASE tools have historically been used more for mainframe-centered application development, and have also suffered from confusion over standards and from lack of substantial evidence of software productivity development enhancement. However, over the past year there has been much more linkage between various types of application development tool technologies to address distributed application development. CASE tools are finding more acceptance in this area as front-end tools for process re-engineering applications. 4GL tools have been benefitting from their cross-platform application development and report generation programming strengths, as the world of network processing moves more toward distributed data base processing across heterogeneous platforms.

Object-oriented technology is also increasingly being incorporated into application development tools frameworks to enhance cross-platform programming development and also to enhance software products through code reuse. This is especially evident to date in the development of front-end, client/server-based applications.

The U.S. market for object-oriented data base products and services continues to be relatively small (an estimated \$30 million in 1992) compared to a U.S. relational data base market of close to \$3 billion in 1992. However, object-oriented data base management systems and application development tool technology is gradually being incorporated into the relational data base application development tool market, and thus the relative importance of object-oriented application development tool technology is not accurately reflected in the \$30 million figure.

c. Systems Software Market Forecast

i. Overall Market Growth Rate Forecast

As indicated in Exhibit III-1, INPUT forecasts that the systems software market will expand from \$21.7 billion in 1993 to \$31.2 billion in 1998, for a Compound Annual Growth Rate (CAGR) of approximately 8%. This reflects a dramatic lowering in growth rate expectations from INPUT's projection in 1992 of the five-year 14% CAGR for the systems software market. This revision reflects INPUT's growth assumptions for the domestic economy over the next few years at the low end of the 2.5% to 3.0% that was estimated in 1992; a downward revision in the growth forecast for the systems control product market, reflecting more intense pricing pressures from increased product competition and product standardization; more bundling of systems software solutions, particularly operations management and systems control; and short-term user confusion about migration approaches to distributed processing.

EXHIBIT III-1

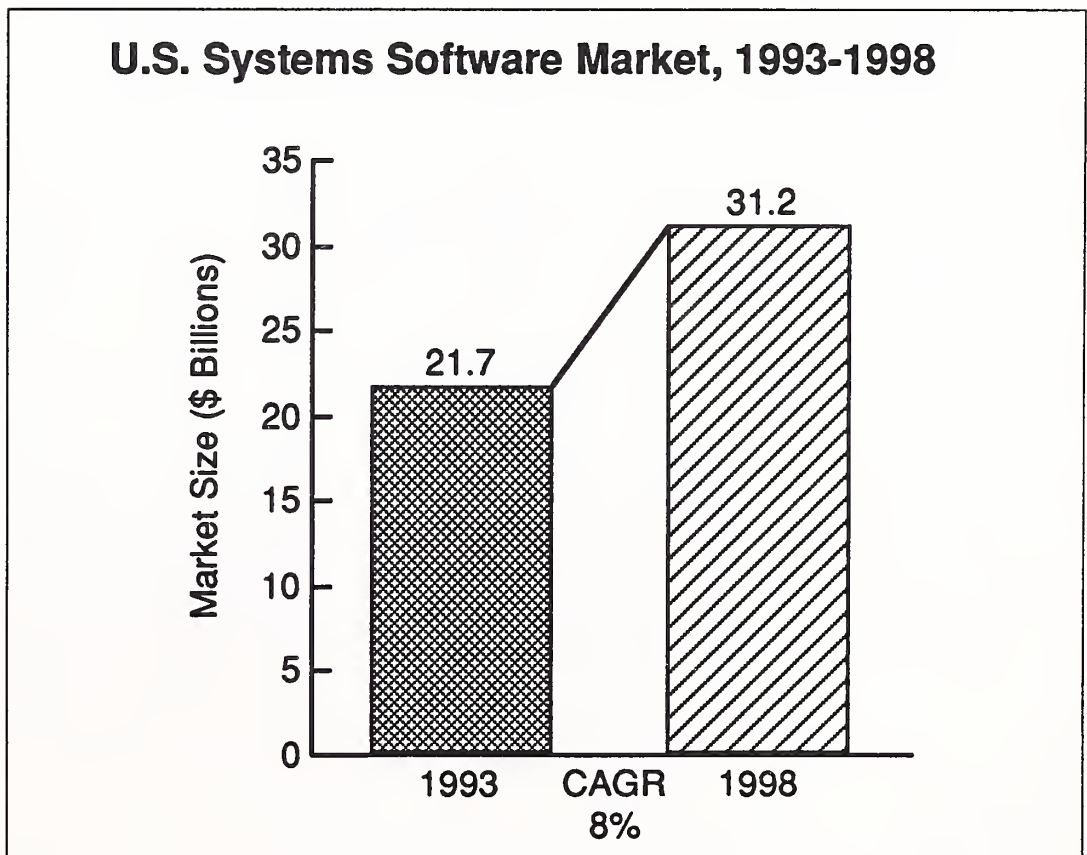
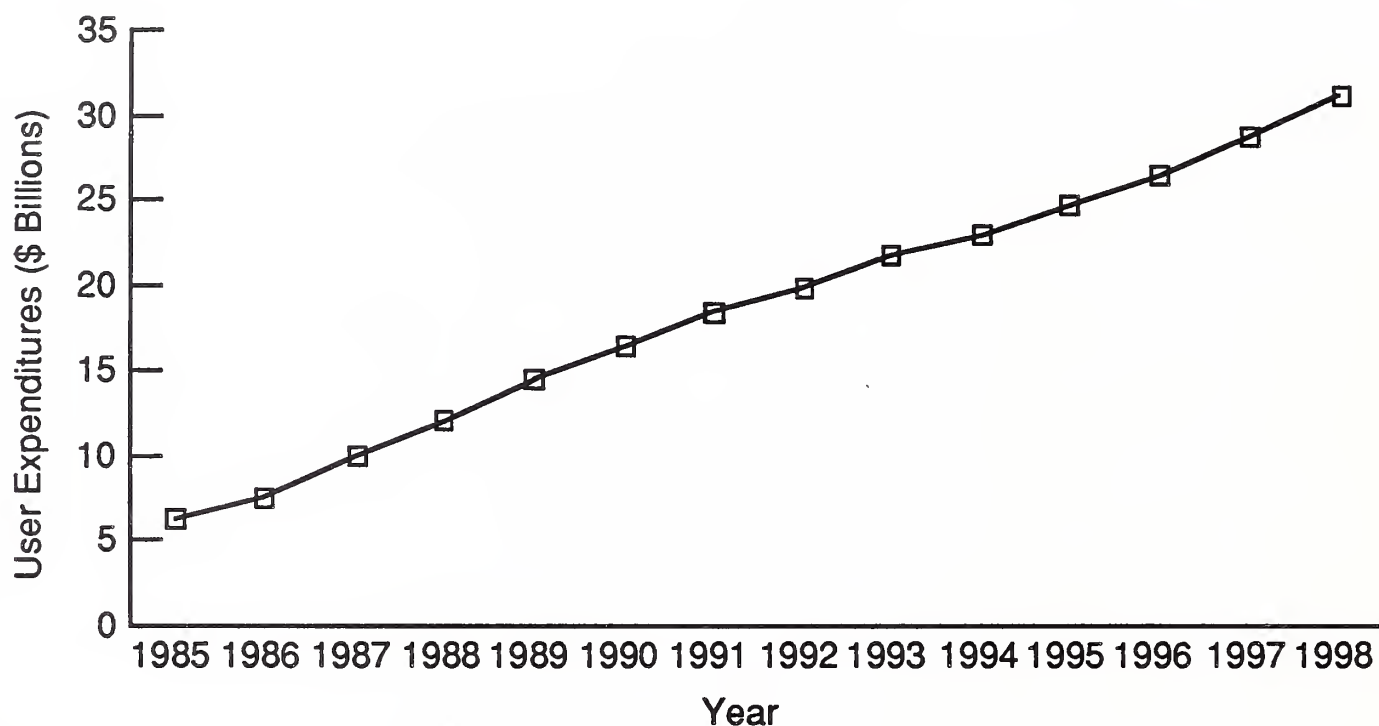


Exhibit III-2 outlines the historical growth of the U.S. systems software market from 1985 to the present, along with INPUT's projections for specific market size in each of the years from 1993 through 1998.

EXHIBIT III-2

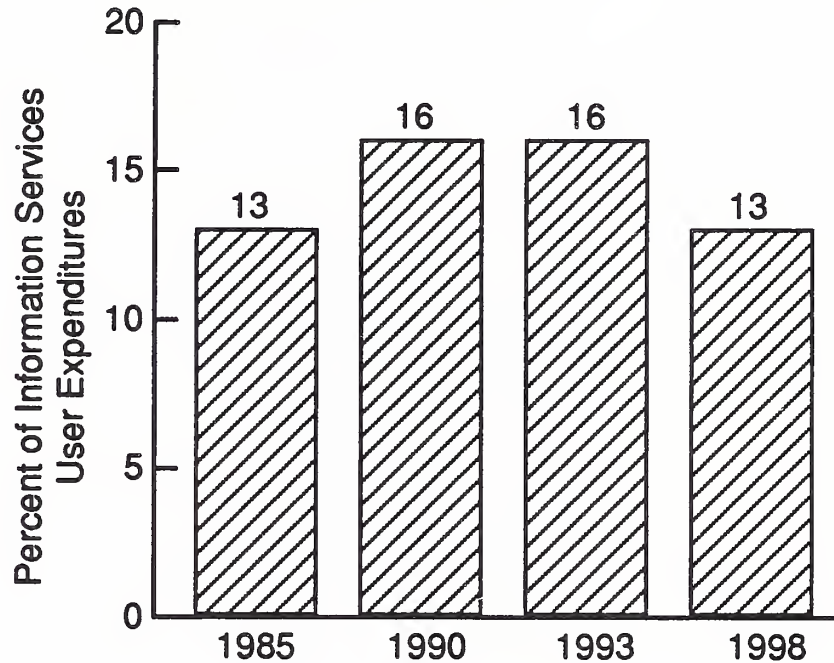
User Expenditure on Systems Software, 1985-1998



Of the projected total information services market of \$135 billion in 1993, the systems software market is projected to represent 16%, as shown in Exhibit III-3. Systems software is projected to represent 13% of the total information services market in 1998. The market for applications development tools is expected to grow at a significantly faster rate than the other two segments, systems control and operations management. This reflects the potential for value-added features and pricing of application development tool products (and services) over this time frame, particularly during a period when cross-platform application development will require much more complex tool sets. Also, the growing sophistication of application development tools could eventually have a significant positive impact on the cost of software application. Eventually the two markets for application development tools and application products will blend. Even today, it is difficult to separate application development tool products from application development services, a potentially enormous market relative to systems software products, in general.

EXHIBIT III-3

System Software Products as a Percentage of U.S. Information Services Market, 1985-1998



\$ Billions

System Software Products	6.3	16.4	21.9	32.1
Total Information Services	48.6	100.4	135.4	235.9

INPUT is emphasizing in this report the value to systems software companies of rapidly expanding their capabilities in application development tool technologies and reorienting their product focus to services markets such as application development and implementation. The latter represent the major market opportunities for systems software companies in the second half of the 1990s.

ii. Systems Software Forecast by Market Subsegment

- The slow growth in the systems control market reflects primarily the impact on pricing from the higher growth rates in the smaller platforms as well as the transition from proprietary operating systems pricing to more open systems product pricing.

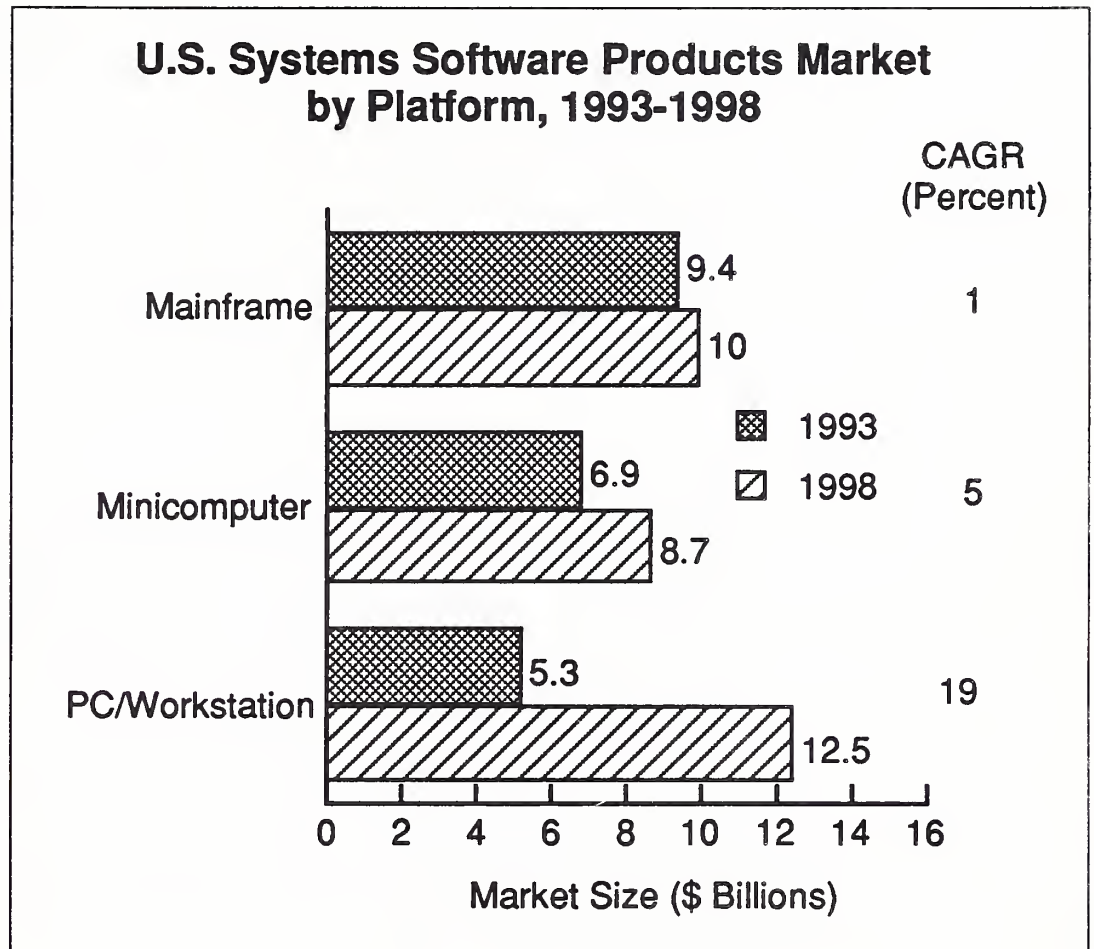
What will be particularly interesting to observe is the impact that Windows NT will have on workstation and mid-range operating systems product pricing. A major pricing war between Windows NT and the UNIX open systems product could develop, and the expected bundling of Windows NT on lower-priced platforms could set a relatively low price value on the system by resellers. In addition, the bundling of multiple systems control product functions as well as systems management functions could require vendors focusing more on such single feature products to reduce prices.

- The total systems software market forecast has been revised downward substantially, from a 14% CAGR in the 1992-1997 forecast to an 8% CAGR in the 1993-1998 forecast (see Exhibit III-2). The principal factors contributing to this adjustment were: much lower shipment rate forecasts for both mainframes and minicomputers, softer pricing for mainframe and minicomputer systems software products, increased pricing competition from workstations and PCs in a shift to distributed processing, and pricing pressures from an anticipated move to open systems. In addition, Windows NT, with operations management and network operating system functionality bundled with operating system software, could also put pricing pressure on these segments of the systems software products market.

Although five-year CAGR forecasted growth in the application development tools market was revised downward from 15% to 12%, INPUT projects that this product area will experience the strongest demand among these three sub-modes, as well as the greatest amount of value-added pricing flexibility. Current application development tools for cross-platform (heterogeneous) environments are lacking, and there is considerable opportunity for companies to develop more comprehensive tool solutions. In addition, good application development tool frameworks will enable systems software companies to gain greater market share in the potentially huge customized application development market.

- Exhibit III-4 provides INPUT's forecast of systems software products by platform size. As would be expected, the bulk of current expenditures are for software products that run on mainframes, because of the generally greater per-unit software product cost.

EXHIBIT III-4



With the downsizing trend, and also due to continually decreasing prices, mainframe-based systems software products will continue to increase at a slowing rate (with the exception of negative growth expectations for systems control software), with emphasis on products that enhance efficiency. Existing mainframes will continue to be used for large On-Line Transaction Processing (OLTP) applications and as large data repositories.

Vendors are beginning to introduce systems control and operations management products for minicomputers. UNIX will gain momentum at the workstation/PC and minicomputer level.

A noticeable shift is underway toward operations management and applications development tools that run on workstations and personal computers. The market for systems control products is heavily weighted toward the mainframe because of the high mainframe-based operating systems licensing fees. In addition to the slowing shipment rates of mainframes, systems software vendors are changing mainframe systems software product licensing and maintenance fees to more user-based and longer-term, fixed fee contracts. This will continue to have a moderating impact on mainframe-based systems software markets. The change in licensing alternatives will also similarly impact minicomputers, workstations, and PC systems software profitability over the long term.

It is in the application development tool market that software for the mainframe platform will show growth above anticipated mainframe unit shipments (now in the negative 5% range). Enterprise-wide applications will eventually be connected through a common corporate data base repository (sometimes referred to as a data warehouse). It will be many years before OLTP solutions can be fully trusted on just a distributed network, with no mainframe central data repository. This reflects the lack of good system-wide distributed processing operations management tools and the lack of definitive models for data base OLTP updates with strong backups for data base security and synchronization throughout an enterprise.

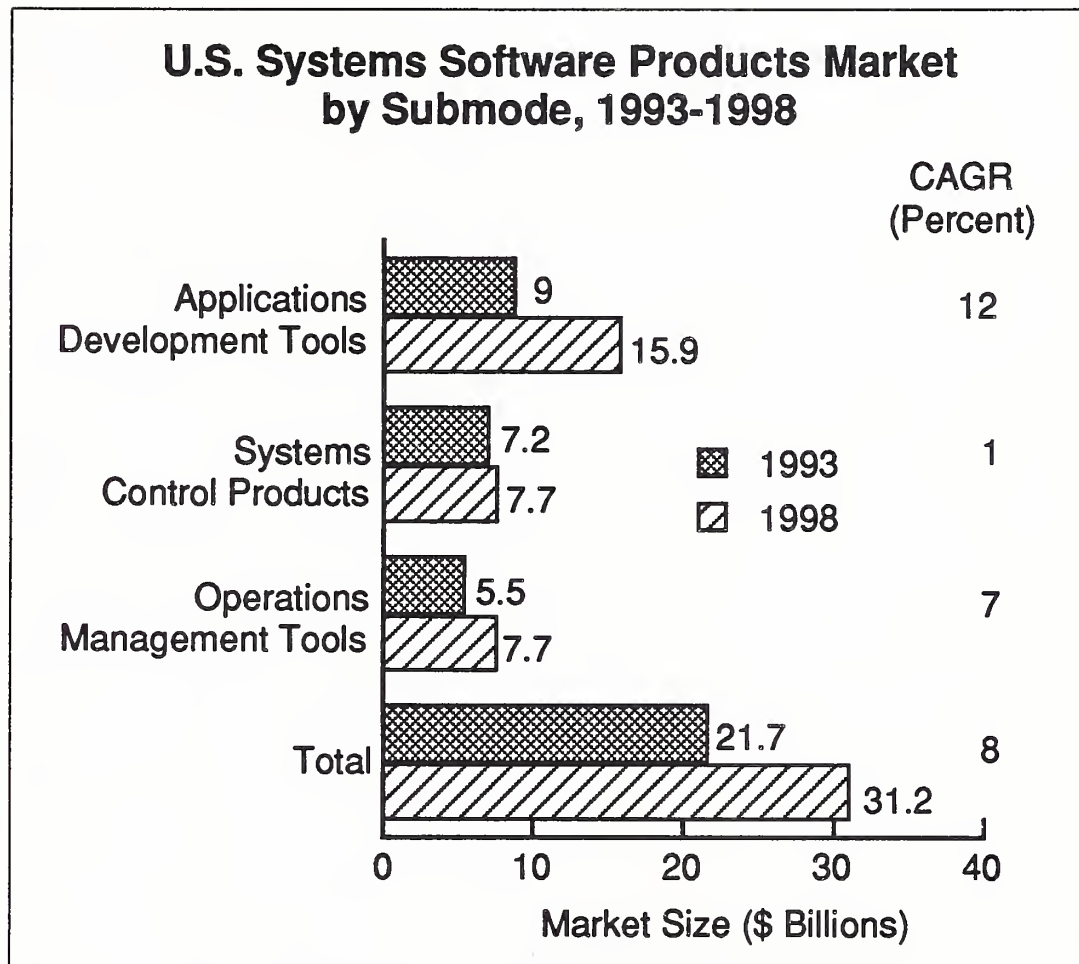
There will also be some modest mainframe systems software growth in the operations management subsegment. This reflects the need for a centralized, integrated solution for distributed, cross-platform operation systems management. The need for distributed operations management (particularly for open systems) also will stimulate growth for minicomputer-based operation systems software over the next few years.

There is continuing pressure for data center operations management "lights out" solutions to increase productivity in the centralized data center. There will be even more pressure for such solutions as data processing resources are reallocated to network-based, departmental data processing environments.

A complicating factor in predicting growth rates for systems software for mainframe and minicomputer platforms is an expected revision in the nomenclature of these platforms over the next few years, as mid-size platforms, in particular, become more specialized in application. A major development effort is underway, to a change in computer architecture toward massively parallel computing. An initial application appears to be for large transaction processing environments and on-line data bases.

Exhibit III-5 defines the forecast by delivery submode.

EXHIBIT III-5



B

Driving Forces

The key driving and inhibiting forces for the systems software market are listed in Exhibit III-6.

EXHIBIT III-6

Systems Software Market Driving/Inhibiting Forces

- Slow growth economy
- Open systems
- Client/server computing
- Interoperability requirements

All of these forces act as both growth promoters and/or inhibitors to varying degrees and during different time frames. These fundamental forces drive INPUT's systems software products forecasts.

1. Slow Growth Economy

INPUT uses the CONSENSUS TM economic forecast published by Blue Chip Economic Indicators to provide baseline economic assumptions for U.S. information services market forecasts. This service, combined with a growing array of real data points collected by the U.S. government, forecasts a modest return to growth in 1993, followed by five years of steady growth in the GDP. The CONSENSUS report and other economic forecasters predict the real GDP to average 2.5% to 3% over the next five years. However, recent federal tax legislation, which increases taxes on U.S. corporations, could have a dampening effect on corporate capital spending in the short term. In addition, many European country economies, a major market for U.S. software products companies, are continuing to demonstrate a downward trend in economic growth. Thus, there could be at least a couple more years of flat economic growth in the major markets served by U.S. software product companies. The softer European economy has had an impact on U.S. software products companies. Novell, in particular, noted the negative pull of the European economies on its recent July fiscal quarter.

The Far Eastern economies offer a bright spot, with continuing strong economic growth being exhibited by many companies in the Pacific Rim region. This should be a major target for U.S. software products companies.

2. Open Systems

Although there are a number of definitions of open systems, portability and interoperability of data processing solutions are most commonly used.

The U.S. federal government has been pressing for open systems for several years, with requirements for compliance with a number of standards such as POSIX for both internal usage and for governmental suppliers.

However, pressure for more open systems computer solutions in the U.S. commercial markets has become much more evident over the past 18 months. Examples of recent success of an "open systems" solution are the acceleration in the growth rate for UNIX-based computer systems, which has been particularly evident at companies such as Hewlett-Packard, NCR, and Unisys over the past year, and continuing strong demand for UNIX-based workstations from traditional suppliers such as Sun Microsystems. Larger commercial software companies have announced UNIX versions of their software products within the past year.

User groups, in particular, have been putting pressure on U.S. computer systems and software product vendors to provide open systems solutions. A driving force from the user, based on INPUT's recent research, is reduction in complexity of solutions as users move to lower-cost, distributed hardware platforms. The cost savings of these moves has been somewhat elusive; application development and management across a more heterogeneous mix of platforms is a principal reason that cost savings have not been more material.

The demand for open systems will have a mixed impact on U.S. computer systems and systems software vendors. Although demand will increase for products that provide a distributed processing solution, vendors' profit margins will likely decrease for many products as they become more standardized.

This means that systems software vendors will need to add products that will enhance their overall total solutions capability to get value-added pricing. In addition, systems software vendors will need to provide (either internally or through partnerships) cross-platform development tools, that will allow them to deliver cost-effective customizable solutions for additional revenue sources.

3. Interoperability Requirements

Distributed processing solutions are in an emerging phase. A number of de facto standards are emerging to solve enterprise-wide, inter-networking type applications.

Integration and interoperability solutions remain elusive, and administering an enterprise solution is emerging as a major problem.

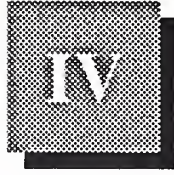
Providing evolutionary and longer-term solutions for integrating and administering distributed, enterprise-wide networks will offer a major market opportunity, particularly for the larger computer systems and software products companies, with more comprehensive solutions.

Cross-platform middleware and application development tools are key product areas for addressing these interoperability issues.

The definition of middleware is somewhat elusive, but "framework" type solutions have been articulated for middleware by a number of computer systems and systems software vendors. Digital Equipment, for example, recently announced such a focus. Software framework units announced by DEC in the middleware product category include a variety of messaging software and production systems software products.

Middleware can provide the basic distributed processing framework or architecture for application interoperability. Middleware may also be described as part of the cross-platform application development tool market, which provides common sets of APIs for mixing applications and data across operations systems and computer systems architectures.

Computer systems manufacturers should look to the total category of middleware and cross-platform development tools to enhance revenues, as operating systems software pricing is likely to decline significantly within the open systems environment.



Trends and Issues

A

Software Markets—Structural Changes

In general, systems software vendors have experienced much stronger growth rates and higher profitability than have application software vendors over the past year.

A significant causal factor is the shift taking place in the corporate computing paradigm toward downsizing/rightsizing, with the distribution of computer resources to LANs and the end user. As a result, many of the traditional application solutions from third-party vendors that address the mainframe and minicomputer markets have experienced considerable softening in demand from prior years.

In contrast, particular segments of the systems software products industry, such as application development tools and operations management products for workstations and minicomputer platforms, have shown particular strength.

Complicating the demand factor for application software products is confusion on the part of users about the proper migration strategies for implementing a rightsizing program. This has delayed buying decisions.

A number of issues are yet to be resolved: The proper migration strategy, who should implement it, and how to quantify rewards from corporate IS rightsizing. Clearly, the cost of hardware, as measured by traditional price/performance factors, has come down dramatically. Logic would suggest that overall corporate data processing costs should also show significant reduction from utilizing the lower-cost computer architectures, and user productivity should also be showing some proportional improvement.

Much of the redistribution of corporate IS resources over the past few years has been to the departmental level, accompanied by the implementation of client/server-based local area networks. This reflects, in part, the number of quality applications which have been developed for office (front end) local area network computing solutions, with the attendant benefits of reduced cost of application per computer user, based on concurrent usage product licensing. In addition, enhanced access to information through inter-networking of data base servers has resulted in a qualitative improvement in decision making by corporate management.

The systems software companies have been major beneficiaries of the more recent acceleration of the downsizing trend to client/server-based inter-LAN computing. Relatively few standard applications software products are currently available for this movement to inter-networking, which often involves migration of "back office" applications to the LAN environment. Application development tool companies as well as networking operating and services companies have been beneficiaries of the need for users to build their own client/server solutions.

Over the past year there has been increasing demand from corporate management (not necessarily supported by the IS department) to rightsize the central IS or back office computing structure. This development can also be viewed in the context of the general trend in corporate America to restructure/re-engineer corporate business processes to reduce corporate cost structures. How to change the traditional vertically structured corporate IS computer paradigm through the reduction of corporate information processing costs and the enhancement of productivity of key mission-critical corporate processes will be principal issues for software vendors over the next several years.

INPUT believes that the shift to rightsizing within the corporate IS model will provide considerably more market opportunity for systems software vendors and computer systems vendors possessing total software and services solutions capabilities than it will for the traditional application software vendors. However, both the application software and systems software vendors can benefit by working more closely together to provide such total solutions capabilities.

Within this general rightsizing trend, there are a number of significant issues that must be addressed by systems software vendors to maximize their revenue growth and profitability potential. The remainder of this chapter will deal with these issues within the context of industry trends associated with the rightsizing of corporate data processing.

B

Decentralization of Corporate IS Computing—Trends and Issues**I. Heterogeneous Computer and Operating Systems Connectivity Issues**

A significant cost factor in rightsizing is the need to support a number of diverse hardware architectures and operating systems platforms. INPUT surveys of the corporate IS user community strongly indicate that overall software product and maintenance costs have not shown significant reduction with the move to lower-cost, networked platforms.

Portability and interoperability of applications and data base architecture are viewed as very important in reducing software costs, an area where rightsizing has not yet produced meaningful cost reductions.

This in turn will continue to bring pressures from both the user and vendor communities to reduce application licensing, maintenance, and support and training costs through the support of standards and open systems in software architectures. Definitions of open systems vary (see Exhibit IV-1), which further complicates the issue of what constitutes the optimal open systems solution. Portability of applications, however, appears to be the most frequently cited characteristic of open systems computing.

However, *how* standards-based solutions should be developed is a key issue.

EXHIBIT IV-1

Definitions of Open Systems

- Portability of application
- Interopability of data base management
- Support of standards
- Plug and play integration
- Well-defined interface standards-accessible to everyone
- Hardware independence
- Provide for application flexibility
- Provide user with choices—to integrate multiple products from multiple vendors
- Support for major development languages

Standards—de facto and de jure

The number of standards has continued to proliferate over the past few years (see Exhibit IV-2). User-based groups such as X/Open have for several years been working to reduce the number of architectures/interfaces used by vendors to a manageable group of standards. Government-sponsored groups such as the International Standards Organization (ISO), CCIT, and the National Institute of Standards and Technology (NIST) have also been working for vendor consensus, but it has taken the threat of major new competition in the industry to finally force the vendor community to seriously consider support for open systems and related standards.

EXHIBIT IV-2

Selected Standards in Progress

Screen	Microsoft Windows, Presentation Manager/OS/2 OSF/Motif; X/Open; NewWave; Nextstep; Display PostScript; Quarterdeck's Desqview; Open Desktop
Graphics	TIFF; PICT; CGI; CGM; DMS; WKI; OGES; SGML; ODIF; DDIF; (DEC); PDES; PDF; JPEG
Communications	OSI; SNA; Ethernet; Token Ring; SONET; TCP/IP; MAP/TOPS; LU6.2; APPC/CL/I; NFS C/I; SQLNet; FDDI; X.400; X.12; X.25; CITT.6 (Group 4); NCS; DetBlos; LAN Manager; SMTL CMIS/CMIP SNMP; ISDN; NetWare CICS; TopEnd; Tuxedo
DBM's	Codd's Rules; SQL; ANSI SQL; DB2; ODBC; RDA; XA; CORBA, OSF/DCE
Printers	Adobe's PostScript; DDL; Microsoft/Apple TrueType
Program Interfaces	IBM's SAA; POSIX; OPEN DOC; OS/2; Workplace HP's Vue Desktop Environment; COSE/ODE
Operating Systems	MS-DOS; OS/2; VM; MVS; UNIX; DEC VMS; PICK; Windows; Windows NT
CASE	AD/Cycle; CDD/Plus; IRDS; EDIF; CIS

The agenda of the Applications Portability Profile (APP) of the NIST to provide a "standards framework" for multivendor interapplication communications reflects the complexity of interface issues that need to be addressed. The functional areas of communications and applications protocol interfaces that have been under consideration include operating systems, data base management systems, data interchange, network services, and user interfaces and programming services. Particular standards associated with APP to be used for federal agencies include: POSIX application program interface standards, X Windows, the OSI protocol stack, and the ISO/ANSI standard Structured Query Language (SQL). A basic concept underlying this effort is that applications and end-user portability can be achieved with applications programming interface (API) standards and acceptance of a common windowing graphical interface convention.

Another major federal government standards effort is the CALS (Computer-Aided Logistics and Support) standard initiative, which helps provide standards for electronic document and data base generation and management for DoD computer systems and other military procurement programs. Eventually proposals and other types of documents submitted to federal agencies will have to conform to the SGML (Standardized Generalized Markup Language) standard, which defines particular text objects/elements for document format portability. Other standards efforts surrounding CAS include Initial Graphics Exchange Specification (IGES) to permit intersystem data transfer between CAD/CAM vendors.

Although announced support for the inclusion of POSIX APIs and SGML has become more commonplace, the progress of de jure/government sponsored standards in influencing the commercial computer community to move toward open systems has been only moderately successful.

However, the past year has evidenced a major new interest by the commercial computer community in open systems, as defined by support of particular application programming interfaces (APIs), established by vendor "consensus" groups.

EXHIBIT IV-3

Selected Examples Vendor Consortium-Sponsored Standards Initiatives

- OSF-DCE, DME
- SQL Access Group-RDA/RPC
- COSE (Common Operating Systems Environment)

Probably the most significant influencing factors have been the need to market products within the context of heterogeneous corporate computing environments and the threat of major new systems software solutions which could provide a comprehensive open systems environment, to the exclusion of many systems software vendors.

These vendor consensus groups have generally centered around operating systems portability, management of distributed applications, and distributed relational data base management systems interoperability. X/Open, one of the major user-participation groups, is also being more closely consulted by these vendor-sponsored standards groups.

The most significant factor prompting vendor consolidation around systems software is the new challenge Windows NT poses to the traditional operating systems' domain of the large computer systems vendors, with their large, installed base of proprietary operation systems. The issue at stake is what will ultimately become the enterprise-wide operating systems environment in a right-sized, network-based, IS computer paradigm. In particular, this has brought together factions within the UNIX environment in the COSE (Common Operating Systems Environment) initiative, which includes vendors of both the OSF and USL vendor subgroups to create portability between the two major flavors of UNIX. The first offering will be a consistent desktop operating (CDE) environment.

Microsoft also has established a number of vendor relationships for its Windows NT enterprise-wide operating system solution. Unlike the UNIX vendor group, Microsoft appears to be directing more of its alliance effort toward becoming the de facto enterprise standard for applications software vendors and corporate developers. However, Microsoft has also garnered a number of systems software supporters for its key APIs within Windows NT, such as its Open Data base Connectivity (ODBC) application programming interface for client/server interconnection. A rival standard from a consortium including Borland, IBM, Novell, and WordPerfect is the Integrated Data base Application Programming Interface (IDAPI).

2. UNIX versus Windows NT as De Facto Standards for Enterprise-Wide Computing

Probably the biggest debate in the systems software arena over the next few years will be over Windows NT and Microsoft's next generation, enterprise-wide operating system, code named Cairo, versus a "unified" UNIX as a better alternative for the right-sized corporate computing platform.

It would appear at the time this report is issued that neither Windows NT nor the UNIX alternatives have relative feature superiority, but rather, the magnitude of corporate and other user preference for the alternatives will determine the relative success of the two operating systems for enterprise-wide computing.

Exhibit IV-4 is INPUT's forecast of the estimated success of Windows NT versus UNIX and other de facto operating systems standards over the next five years. It suggests that these two will capture approximately equal shares of the market in five years. However, the "wild card" in the operating systems wars will likely be object-oriented technology. An object-oriented operating system architecture could eventually provide the real portability/interoperability required for truly distributed, open systems computing.

EXHIBIT IV-4

Operating Environments, 1993-1998

Operating System	May '93 installs	1993			1994			1995			1996			1997			1998		
		ship	cum	%	ship	cum	%	ship	cum	%	ship	cum	%	ship	cum	%	ship	cum	%
UNIX	26	5	31	17	7	38	18	12	50	19	17	67	21	24	91	24	25	116	26
AS/400	0.3	0.08	0.375	0	0.1	0.475	0	0.1	0.575	0	0.1	0.68	0	0.1	0.775	0	0.1	0.88	0
OS/2	2	1	3	2	1	4	2	1	5	2	1	6	2	1	7	2	1	8	2
DOS*	120	24	144	81	26	170	79	20	190	73	12	202	64	3	205	55	1	206	46
NT	0.1	0.3	0.4	0	3	3.4	2	12	15.4	24	24	39.4	13	30	69.4	19	50	119	27
Total	148.4	30.4	178.8		37.1	215.8		45.1	261		54.1	315		58.1	373.2		77.1	450	

ship = shipments for that year

cum = cumulative installed base (that year's shipments plus previous year's cumulative)

% = share of installed operating systems listed

UNIX includes all versions of UNIX

* DOS includes Windows that runs on DOS

(all numbers except percentages are in millions)

The first release of an object-oriented operating system, NextStep, may not be the initial big winner in the competitive arena of object-oriented computing, but it could become a significant application development platform for a UNIX open systems solution, particularly if NextStep were incorporated into a UNIX standards initiative such as COSE.

The major contests among object-oriented computing systems may be among Taligent (including possible layered Taligent solutions over other operating systems software kernels), Cairo, and object-oriented, layered versions of UNIX. However, these approaches will require a major rewrite of current applications, and thus acceptance of this technology could continue to stretch out well into the latter part of this decade.

Thus a discussion of the pros and cons of the two operating systems most likely to compete for dominance as enterprise-wide solutions in the new era of "open systems" computing is more realistic. Comparative advantages of UNIX and Windows NT are summarized in Exhibits IV-5 and IV-6.

EXHIBIT IV-5**Advantages of UNIX**

- Peer-to-peer, distributed networking
- Degree of openness-sharing of technology among partners
- Long history of development
- Potential for unified version COSE and OSF distributed processing initiatives
- Scalable and extensible

EXHIBIT IV-6**Advantages of Windows NT**

- Common "Look and Feel" interface with popular Windows/DOS, and expected Windows 4.0 ("CHICAGO")
- Potentially lower cost than competing operating systems within built-in networking characteristics
- Scalable/extensible
- Strong established Windows user base for application developers to migrate

Both are scalable/extensible operating systems that can be ported to nearly all existing computer architectures with relative ease, from the desktop to the massively parallel super computers.

a. UNIX Advantages

UNIX has an advantage of having been in existence for over 20 years, and it probably has less risk at this stage for running mission-critical applications. In addition, a strength of UNIX is in its communications capabilities. UNIX, which is inherently a network-based system, with a peer-to-peer communications structure, also has such features as error protection and auditing functions built into its UNIX UUPC communications protocols. Thus, UNIX could have an initial advantage over Windows NT in facilitating distributed application processing.

UNIX systems' peer-to-peer networking services also allows a system to function as a client or server. OSF/Motif, a standard UNIX interface, is based on the X Windows System, a graphical user interface (GUI) designed to be networked.

The support of UNIX communications protocols in Internet enhances inter-company computer communications applications, such as EDI. This could also significantly enhance other types of inter-connected processing applications among companies.

The multi-user UNIX capability has also helped total solutions providers achieve lower costs per user than competing operating systems.

UNIX and Windows NT Advanced Server are designed to network a number of processors and to distribute the processing of data among applications residing on multiple platforms. Most proprietary operating systems were designed to optimize a single CPU architecture.

UNIX works comparatively well in mixed-system networks. UNIX systems have become particularly popular as data base servers and communications gateways. UNIX workstations can also be used as both servers and bridges or routers for multiple networks, and a wide variety of utilities are built into UNIX that can be centrally administered.

UNIX has been a fast-growing operating system for client/server data base servers. Also, a number of UNIX-based application programming and report generation tools have been developed for client/server data base solutions. Some of these tools are also now beginning to offer cross-platform UNIX independence. Applix, Inc. provides Extension Language Facility (ELF), a UNIX-based, object-oriented tool which enhances such applications linkages. Others with strong 4GL and 5GL capability include LINC and 2 (from Unisys) and Sybase, with its recently acquired Gain Technology, based also on object-oriented technology.

Most of the mainframe and mid-range computer systems vendors have adopted a version of UNIX as an open systems alternative to their proprietary operating systems. Hewlett-Packard, for example, has also established interoperability between its proprietary and HP/UX operating systems.

A number of leading mid-range software vendors that provide applications for proprietary operating systems have over the past year provided UNIX version alternatives, usually for the DEC and HP UNIX versions.

Development of UNIX commercial applications can also be complementary to enterprise-wide connectivity with the large installed base of research and scientific-based corporate UNIX applications.

Newer application program interfaces are making it easier to run Windows applications that display on TCP/IP (UNIX) computers. With the Windows Socket (WinSock) API, created by a group of 20 vendors including DEC, IBM, Novell, and SunSoft, Windows programs can use a variety of TCP/IP (UNIX) services, thus reducing the need to have two desktop systems to work with Windows and UNIX programs.

b. UNIX Disadvantages

A principal current disadvantage to UNIX is the use of multiple versions of the language. The distributed processing standards being developed by OSF will help address interoperability among the variants of UNIX, if the standards are supported by the various UNIX operating systems vendors. X/Open is also working with the newly formed COSE group, which represents the initial attempt for OSF/USL application portability, to provide branded versions of a unified UNIX product.

Powerful proprietary systems such as MVS (IBM) provide strong system management and resource management facilities with interfaces which facilitate the work of other software companies to add complementary systems management products. The lack of consistent interfaces which work across the various versions of UNIX makes it more difficult for third-party systems management software vendors to enhance system management capabilities of UNIX. This is an issue which will need to be addressed for the vendor standards groups working to provide a multivendor enterprise UNIX solution.

There has been a general lack of good systems management tools for open systems such as UNIX. However, new open systems data center tools, such as CA-Unicenter from Computer Associates, are addressing this issue. CA-Unicenter addresses a wide range of systems management issues, such as security of tape management, desk management console automation, help desk, scheduling, print spooling, report management, and resource account.

In general, UNIX-based LAN environments are more complex to manage than Windows/DOS environments and thus could increase LAN management costs. However, this also provides an opportunity for third-party vendors to provide systems administration services for UNIX-based network solutions.

UNIX continues to be one of the more difficult operating systems to program, but a number of new application development tools from UNIX vendors should ease this considerably. However, programmer retraining to work with UNIX can add an additional cost for IS departments deciding to migrate from Windows/DOS to Windows NT or UNIX.

NetWare and UNIX applications currently need to be run on separate servers to create interoperability between their two network operating systems. However, Novell is moving its System V Release 4 operating system to a microkernel architecture, which will enhance UNIX and NetWare inter-networking. This will allow users to host NetWare applications under the System V Release 4 operating system. Eventually, there could be a single, unified System V Release 4/NetWare server. The microkernel architecture will also allow users to customize their operating system environments by adding layers to the basic microkernel for distributed applications, which could also allow for support for cross-platform (NetWare, DOS, Windows, and Macintosh) applications. This microkernel's modular architecture also will facilitate the use of object-oriented programming and can also likely provide a path to delivering an object-oriented version of UNIX. The object-oriented programming features allow for the encapsulation of systems elements to enhance distributed applications development.

c. Advantages of Windows NT

The built-in networking characteristics and application-to-application communications capabilities of Windows NT should be a major plus for client/server application development.

The NT Microkernel architecture automatically scales across a wide variety of hardware platforms.

Windows NT, a 32-bit operating system, incorporates many advanced technologies, such as symmetric multiprocessing (SMP), TCP/IP networking, a sophisticated security system, built-in versions of MS-DOS and OS/2 1.3, a POSIX C shell for UNIX C programmers, LAN Manager client software called Workgroup Connection, and support for NetWare's IPX/SPX.

With all the bundled capabilities built in, along with the combination of a network operating systems and applications server, it could be less expensive than other client/server operating systems solutions.

Windows NT continues to support a common Windows programming/user interface, which reduces programmer and user development and training costs. In addition, with the large installed base of Windows-based operating systems, applications vendors have a huge potential market to migrate to enhanced 32-bit, Windows-based solutions.

An important attribute of NT versus other operating systems alternatives is its built-in symmetric-multiprocessing (SMP) capabilities. Companies with SMP and parallel processing architectures, including Sequent and NCR, appear to be showing particular interest. Apparently all UNIX versions do not provide a consistent multithreading/multiprocessing capability.

With its support of distributed architectural standards such as DCE, Windows NT can also be used in a heterogeneous distributed computing environment.

d. Disadvantages of Windows NT

Windows NT as a new system will face a period of testing before IS managers will trust it for mission-critical applications development.

Windows NT could be described from the perspective of other vendors as being a somewhat proprietary systems software solution. Although based on a microkernel, to which other vendors can contribute parts of their technology, it isn't fully open in that other vendors are not currently allowed to modify the technology. Microsoft indicates it intends to keep Windows NT as a homogeneous technology. Contributions from other vendors will be integrated by Microsoft, but there could be a question of a royalty payment on such contributions.

A major issue for computer systems vendors who decide to resell Windows NT as their principal operating system is: how much value will there be in the resale price, considering that many of the PC computer systems vendors will likely bundle the software, and possibly establish a relatively low value for the software? From Microsoft's perspective, it is saving computer systems vendors a great deal in research and development expense by not having to create their own operating systems.

In theory, this will pressure computer systems vendors to sell more professional services to maintain growth and profitability from computer systems sales.

Since there are systems management features incorporated into Windows NT, this can also impact systems management software companies—in terms of what added value they can provide to Windows NT.

UNIX will be more open to vendors providing value-added features to their UNIX-based computer systems product, with more consensus among UNIX vendors on de facto standard interfaces.

There is also the question of Microsoft's strategic direction, as to the emphasis it intends to place on providing application software products and solutions for Windows NT—particularly enterprise-wide applications. The issue could arise, as it did for PC applications companies, of potential competitive advantage for a company that controls the operating system development in providing software applications based on the operating system. There is potentially a considerably expanded vested interest vendor group impacted by Windows NT, compared to DOS and Windows/DOS.

Also, since changes in Windows NT and follow-on operating systems from Microsoft will likely not be developed in sync with changes to other operating systems, such as UNIX, there is the potential issue of being locked into a single vendor alternative.

3. Windows NT as a Network Operating System Solution versus NetWare

Windows NT has frequently been mentioned as a significant competitive threat to NetWare as a network operating system solution for LANs or the enterprise-wide network operating system of choice. Windows NT includes networking protocols for: a) LAN manager b) NetWare, and c) TCP/IP.

A principal strength of Novell's NetWare is that it has a reputation for being an open system. In addition, Novell's third-party development partners benefit financially from their contributions to NetWare.

Although NetWare is not a comprehensive operating system such as Windows NT, it is considered a high-performance network operating system. In particular, it provides a strong networking solution for heterogeneous hardware and operating system environments.

Windows NT could provide a significant cost/performance advantage over NetWare with its ability to be a combined applications and communications server. If a number of hardware vendors bundle Windows NT, there could be some very aggressive pricing of Windows NT, which then pressures Novell to lower the price of NetWare and hurts Novell's profit margins.

Novell, however, also continues to add substantial new capabilities to NetWare, including enterprise-wide directory services and system-wide administration utilities in Versions 4.0 and 4.01, which allow for transparent access to servers across the enterprise.

Novell's NetWare management product, NetWare Services Manager (NMS), is gaining the support of a number of third-party vendors of applications for managing hubs, routers, and workstations.

Novell is also developing a NetWare-based system for delivering advanced network services. This could be considered a competitive product to Microsoft's OpenServices Architecture. Such network services will help eliminate the need for applications developers to create their own systems-level solutions. This aids applications developers in creating work flow-enabling software such as Lotus' Notes.

NetWare 4.0 is also being reconfigured to better support transaction-processing journaling across multiple distributed data bases, which will enhance development of OLTP applications.

Novell is also incorporating more object-oriented features into NetWare's suite of services. Novell has indicated that its long-term plans are to make NetWare's Object Request Broker (ORB) interoperate with the ORBs of other UNIX suppliers that comply with the Object Management Group's Common ORB Architecture (CORBA) standard. An initial advantage over Microsoft's Windows Open System Architecture (WOSA) is that Novell's interfaces will work across heterogeneous environments. WOSA initially links only Windows applications with back end network services.

4. UNIX (UnixWare) versus Microsoft's Windows NT and Cairo as Enterprise-Wide Solutions

NetWare users have complained about the weakness of the IPX protocol in wide-area networks. NetWare servers include a TCP/IP protocol stack, but communications with IPX/SPX clients must be through a translation process between the two stacks. Client PCs which access both NetWare and UNIX applications must include both TCP/IP and IPX/SPX protocols. Novell engineers are working on a NetWare/IP product that will give TCP/IP equal access with IPX/SPX to NetWare applications.

It is in Novell's best interest to provide a unified UNIX/NetWare solution, with the cross-platform connectivity which is now a principal strength in using NetWare in heterogeneous computer environments.

UnixWare, however, could also provide an area of conflict for Novell as a strong supporter of open systems. UnixWare essentially competes with other desktop versions, in particular UNIX from Santa Cruz Operations.

One of Microsoft's strongest competitive threats to Novell's NetWare and UnixWare could be the next version of Windows 3.0, code-named Chicago. This 32-bit system, with multi-tasking and other enhanced features, could be the desktop operating system that enhances Microsoft's already strong position as the client/desktop portion of the enterprise-wide client/server solution. Chicago will enhance the migration path to Microsoft's announced next-generation enterprise operating system, the object-oriented Cairo project. Although questions arise about the portability of code from Windows applications to Cairo, Microsoft indicates that working with WIN 32 and OLE 2.0 programming tools will provide much of the core for Cairo program portability. If Cairo is compatible with OSF/DCE and DME standard interfaces, it will enhance Cairo-UNIX interoperability.

5. Cross-Platform Application Development Tools— Object-Oriented and 4GL

A major product need is for cross-platform development tools that simplify the development of applications that operate across heterogeneous platforms. To date most application development tools have been targeted primarily for a single or limited number of operating system environments.

SAS Institute provides one of the best interoperable applications environments. It has developed its own multi-vendor development architecture. 90% of its code is portable among platforms and operating systems, so time and cost of development have been significantly reduced.

SAS Institute works with a number of industry standards and sits on a number of standards boards. Its use of ANSI C is key to the portability of SAS products, and in the future the company also plans more of an emphasis on object-oriented technology.

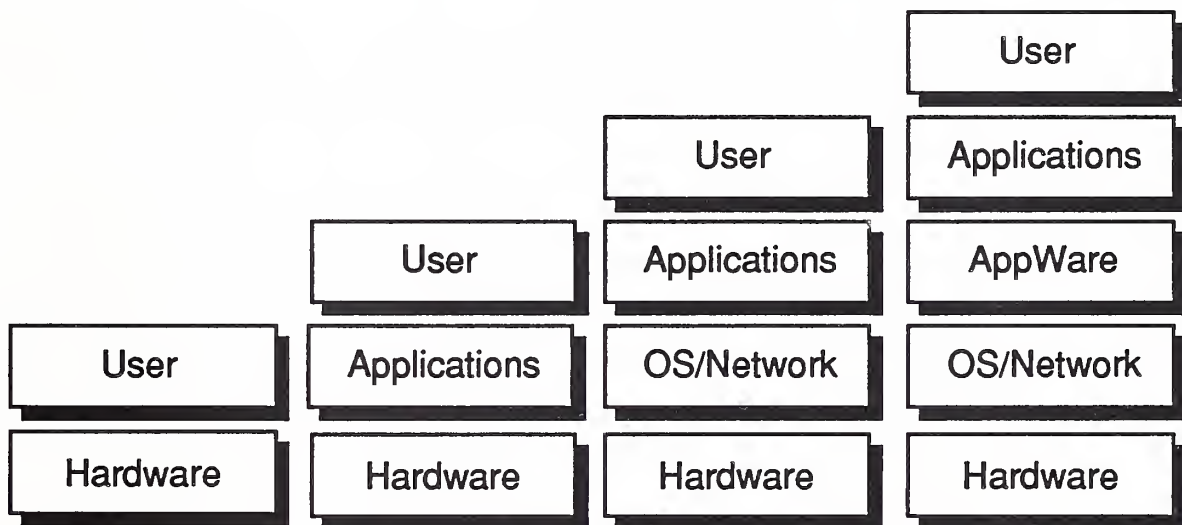
SAS Institute's product solution is one of the best examples of distributed, cooperative processing. Pieces of its various programs run across multiple platforms. The company also positions the mainframe as more of a server—with modules that were developed for the mainframe being ported to other platforms.

Other leading-edge tools for cross-platform development include object-oriented programming languages, such as C++ and Smalltalk, as well as C and non-procedural, higher-level 4GL languages.

Novell AppWare is an interesting new application development tool framework from Novell for unifying the Novell product offerings and for continuing Novell's open system support policy (see Exhibit IV-7). It represents Novell's unfolding architecture for client application development across different computing and network environments.

EXHIBIT IV-7

Application Development Platforms



Source: Novell

Novell describes AppWare as a new system for developing Network Applications. The AppWare system is comprised of two major software components: The AppWare Foundation and AppWare Bus.

These components are designed to provide a consistent set of platform- and network-independent, service-focused interfaces for creating cross-platform network applications, with reusable code for simplifying development in a complex, heterogeneous environment.

AppWare also uses object-oriented, interchangeable software components that eliminate the need for developers to write lines of programming code. These software components are known as AppWare Loadable Modules (ALMs). Third parties can also add ALMS to the AppWare technology.

AppWare also makes it easier to incorporate messaging, telephony, multimedia, imaging, and other networked capabilities into an application.

Novell intends to work with developers, development tool vendors, hardware and operating system suppliers, and other third parties to make AppWare a standard for network application development.

a. Re-engineering—Migration Tools

Another newer area of application development tool technology addresses re-engineering of business processes. This technology is being incorporated as a front end to leading integrated CASE solutions from companies such as Texas Instruments, Andersen Consulting and KnowledgeWare. In theory, such tools will enable the development of enterprise-wide application solutions—an area of wide-open opportunity today.

Another role for re-engineering tools is to provide a migration function from the mainframe to other platforms, based on work flow assessment of how departments and applications throughout an enterprise should be integrated.

An interesting new enterprise application development tool based on the re-engineering of work flow business processes within a corporation is ProcessIt from NCR Corp. This is based on a work flow technology that separates process management logic from application logic for re-engineering legacy applications. It physically separates the two functions and leaves open the alternative of staying with legacy mainframe applications or migrating to smaller platforms, including client/server.

ProcessIT as an enterprise-wide application development tool is now supported on UNIX and will be supported on Windows NT and other platforms as customers demand.

Computer Associates' re-engineering tool strategy is based on the CA90s Cooperative Processing Model, which includes CA-COBOLVISION for analyzing COBOL programs. In addition, Computer Associates provides a number of migration tools, such as CA-PAN/LCM (Life Cycle Manager) for migrating the process of application development and maintenance from the host to the workstation, and CA-PAN/LCM for change and configuration management for use in large, networked programming applications.

The market for change management tools appears to be benefitting from the rightsizing phenomenon. Change management tools for the mainframe are more readily available. Also, a number of partnerships have been developed between change management vendors and applications software vendors.

b. Systems Software Vendors as Application Developers

A major revenue opportunity for computer systems and systems software vendors today is in providing application development and product migration solutions as a substitute for in-house application product development.

Implementing a migration/rightsizing solution has become a major headache for many central IS departments. Lack of application development tools, properly trained staff, contending power issues with decentralized departments, and lack of good Return on Investment models (ROI) all complicate the issues.

For systems software companies (such as DBMS vendors) and computer systems vendors with strong application development tool technology, migration/rightsizing problems for IS present a major opportunity.

Since the vast majority of corporate software applications are developed internally, this is really the major untapped, available market for software vendors for the rest of this decade.

An advantage of the systems software and computer systems vendors is also their "captive", installed base of customers. A basic issue here is that computer systems vendors should be a major beneficiary of their customers' rightsizing programs. A major emphasis by computer systems and systems software vendors is cross-platform application development tools which provide a major competitive advantage in leveraging consulting services and software implementation for the rightsizing market.

Oracle, for example, has recently announced its Oracle Industries program, a customized application development program targeted at particular vertical industries, with partnerships with industry members. Initially, targeted vertical markets represent those with more of a public, general-interest solution, such as education, government, or finance, to enhance sharing of applications development methodology among industry participants.

It also involves the use of application development templates, which include a repository of tested, reusable modules that provide a significant "jump start" in the creation of industry-specific solutions.

Business models are also captured in Oracle's CASE environment, which helps to provide rapid prototyping to improve application development productivity.

The inclusion of VAR business partners also enhances Oracle's total solutions selling capability.

Unisys has also established an application migration development strategy to move its clients from their proprietary mainframes to more open systems, OSI/POSIX-compliant solutions. They are wrapping (encapsulating) X/Open compliance around the mainframe transaction environment to make the mainframe software compatible with open systems, enhancing the development of enterprise-wide OLTP solutions.

c. Middleware and Application Enabling Services

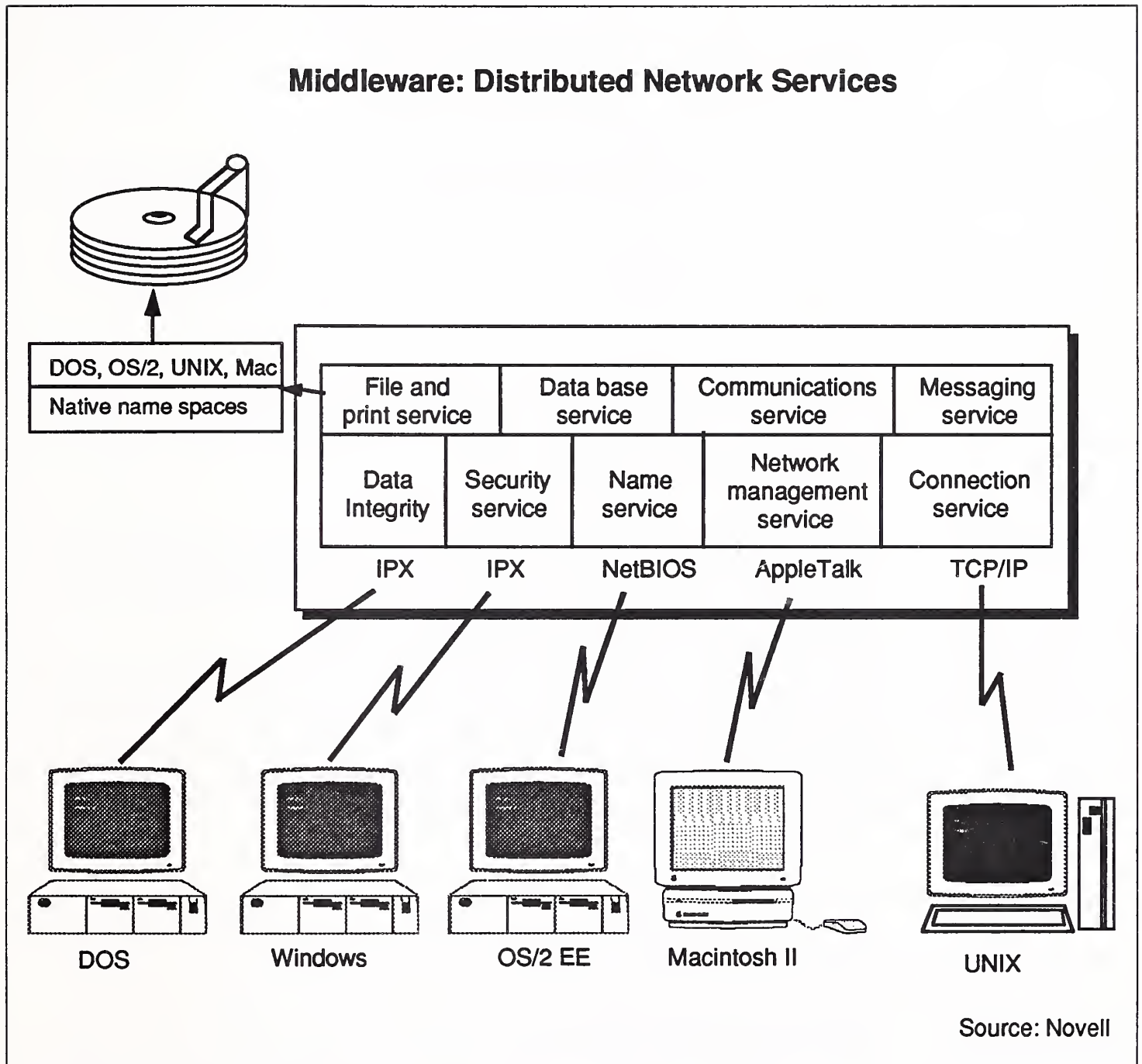
A new category of products which is receiving a lot of attention is that of middleware. As yet, there is no precise definition of the product. The term has been used frequently by companies such as Hewlett-Packard in describing a layer of software which enhances the ability of programmers to develop distributed applications.

One definition is that middleware provides a software bridge between an application and the operating system. It simplifies the development of distributed applications by providing APIs which streamline programming through an environment of diverse protocols, platforms, and programming languages.

More concrete examples of middleware include enabling software such as Lotus' Notes application development environment and Adobe's Portable Document Format (PDF) technology, which it markets under the name Acrobat.

Distributed architectures being provided by vendor consortiums and individual companies can also be considered as forms of middleware. An example of Novell's middleware distributed network services, which runs on NetWare, is depicted in Exhibit IV-8. Known as Novell's Integrated Computing Architecture (NICA), it is an open architecture that can provide such functionality as common file sharing across heterogeneous client platforms.

EXHIBIT IV-8



A discussion is developing within the computer industry as to what characteristics of middleware technologies are best suited for enhancing distributed processing across heterogeneous environments. The two principal competing technologies are based on the message-oriented middleware (MOM) approach, versus the conversation-based remote procedure call (RPC) approach. Message-oriented middleware is mentioned as being better for enterprise-wide communication that takes place less frequently, for example, message-enabled E-Mail.

Middleware is enhancing the development of integrated, network-based application solutions (for enterprise-wide connectivity) and also provides a source of added value for systems software providers who are seeking to enhance their solutions capability.

d. Distributed Relational Data Base Solutions

With recent releases of data base management systems such as System 10 from Sybase and Oracle's Release 7.0, in particular, the era of distributed data base management is beginning to emerge. This includes updates across heterogeneous platforms for transaction processing and the ability to fragment a single local data base across several physically separate processors.

The data base management market consists of query-based systems and transaction processing systems, with each category having its own unique solutions. Transaction processing involves updating of smaller amounts of data in a repetitive manner.

Most data base architectures today that cross heterogeneous platforms are optimized only for query-based processing. Major transaction processing applications tend to be accomplished within the environment of a single-vendor solution.

The technology for heterogeneous transaction processing over the past few years has been based on that of two-phase commit. Newer technologies within distributed data base architecture from companies such as Oracle, Sybase, Cincom, and Computer Associates are emerging to improve upon the current two-phase commit solution, to enhance transaction processing in mixed data base environments.

Another complicating factor in the development of cross-platform, enterprise-wide OLTP solutions is the variety of distributed data base architectures that have emerged within client/server (local area network) solutions. Three such architectures have been articulated by various suppliers of relational data base management software: 1) the Remote Data Access (RDA) Model (ISO defined), where much of the presentation and application logic processing takes place on the client/front end, 2) the Data base Server Model, where most of the data access processing takes place through the use of such protocol standards as SQL, IBM's Distributed Relational Data Architecture (DRDA), and ISO's RDA, with the use of such de facto standards for distributed transaction processing as XA from X/Open Ltd., and 3) the Application Server Model, which is based on the use of transaction processing (TP) models.

Traditionally, TP monitor technology has been used with centralized computing solutions. This is now being incorporated into enterprise-wide distributed processing solutions, and provides for the blending of business application processing with data base processing. A problem for heteroge-

neous processing is the number of leading TP monitors on the market today, including CICS from IBM, Top End from NCR, ACMS from Digital Equipment, Encina from Transarc, Tuxedo from USL, and Pathway from Tandem.

The use of TP monitors as part of the distributed processing solution appears to be an optimal direction to follow today. In particular, this more effectively addresses the issue of data integrity under the two-phase commit approach to provide synchronous data updates.

Inter-connectivity across heterogeneous data bases will continue to be a complex issue because of the need for each supplier of data base management systems to support a variety of remote data request procedures involving competing remote procedure calls, transaction processing monitors, communication monitors, and distributed architectures for ensuring data integrity. This provides a product opportunity for application development tool vendors who are addressing the enterprise-wide distributed processing application development market.

The optimal solution will probably come from the gradual adoption of object-oriented application development technology and standards.

Aggregate Computing recently announced another complementary solution for UNIX workstations called NetShare, which will transparently determine which computers are available in an environment and then remotely execute applications/data base transactions on these platforms. NetShare allows users to process applications in parallel on separate machines. It is based on an object-structured data base. NetShare should be complementary to network environments such as SCE, ONC, and NetWare.

e. Object-Oriented Technology

Object-oriented technology is increasingly being incorporated into application development tools to enhance cross-platform inter-operability of applications. One use is in graphical user interfaces for building client/server applications, as well as its increasing integration in enterprise-wide application development tools such as 4GLs and integrated CASE solutions.

In the future, object-oriented technology could be the ultimate solution for integrated data processing solutions across diverse operating systems, hardware platforms and communications networking alternatives.

The Object Management Group is a leading vendor standards consortium that is developing specifications for the Object Request Broker (ORB), a proposed distributed transport mechanism for objects. OMG is working to provide vendors with a common software interface that can provide applications interoperability and portability across multiple platform networks. The first implementations are in vendor application development tools.

Also, the Object Management Group is developing a Common Object Request Broker Architecture (CORBA), which is a set of specifications for allowing objects to transparently make requests and receive responses across a computer network. The OMF proposal supports two networking protocols—Sun's Open Network Computing (ONC) and HP's Network Computing Systems (NCS). The Transarc transaction processing technology is being used to link the various network computing environments in the OSF/DCE solution.

The CORBA technology is supplied by NCR, Object Design and DEC. OSF and OMG have each agreed to support the other's object-oriented specifications.

The use of CORBA as an application development tool will initiate application programming that splits applications and data bases across platforms and provides an alternative application tool to object-oriented data bases and operating systems. The CORBA model also provides for the encapsulation of legacy applications into objects that work in broader enterprise-wide application frameworks. A principal benefit of object-oriented technology is its ability to address the legacy migration problem.

Object-oriented class libraries are also being developed for resale and reuse by internal developers. However, for class libraries and other object-oriented developed tools to be used widely, there is a great need for the implementation of de facto standards by the vendor community.

There is still considerable debate in the vendor community about the best approach for building a framework that allows varying objects to work together. A principal alternative is an operating system designed initially with object orientation. Another approach being implemented by key vendors is the layering of an existing operating system with a layer that can support object-oriented computing.

Microsoft is proposing its own object-oriented standards, based initially on a Windows API (Object Linking and Embedding 2.0-OLE) and eventually on Cairo. OLE 2.0 currently provides a linking service for objects, but only within Windows.

Another current issue is the importance of object-oriented data base management in the development of future versions of relational data base systems. The leading DBMS vendors have suggested that the next generations of their products will provide object-oriented characteristics, including business modeling capability.

Many application development tools today incorporate some element of object-oriented technology. In particular, developers of 4GL programming and report generation programs are continuing to enhance their application development tools with more object-oriented features.

In addition, object-oriented technology is now beginning to make end-user programming more of a reality for "drag and drop" elements in graphic interfaces. Also, there will be increasing use of such end-user, object-oriented programming tools in soon-to-be released Personal Digital Assistants, particularly for creating personal scheduling and calendaring applications.

IBM also has demonstrated an increasing interest in object-oriented technology. This provides a way for IBM to enhance inter-connectivity among its own and non-IBM platforms. IBM has its own object-technology architecture, known as System Object Management (SOM) technology, which is an object-oriented framework for defining and managing binary class libraries and building distributed applications. HP and IBM have announced licenses for their respective object-oriented frameworks. HP's architecture is now known as the Distributed Object Management Facility (DOMF) and allows developers to create applications that are interoperable. However, IBM has also announced that it will provide support of CORBA for developers of object-oriented applications based on SOM.

In addition, IBM is working with Apple to jointly deliver the object-oriented operating system known as Taligent. SOM and DOMF could be used to provide a layered approach to support distributed object computing for Taligent.

For greater usage of object-oriented language development tools across a distributed environment, however, standards need to be accepted for a single object syntax for a common language and semantics.

6. Operations Management—Systems Management

Operations management systems software includes solutions for capacity management, computer operations scheduling, data center management, disk management, downtime/repair (monitoring management), job accounting, performance, performance monitoring, tape management and other utilities.

There is a general lack of “open systems” data center operations management systems software, as well as integrated operations management, single console solutions. UNIX solutions available are generally specific to a particular platform.

Many larger users of open systems data centers have developed their own management solutions.

There is also a major longer-term need for systems management solutions that work across various platforms throughout an enterprise-wide computing environment.

Providers of such systems management solutions also need to work more closely with equipment vendors that are providing network-based distributed processing architectures.

Although comprehensive, integrated solutions for managing heterogeneous systems across an enterprise are probably a few years away, a number of vendors are beginning to provide pieces of the solution. This includes companies such as Computer Associates, Candle, Legent, Sterling/Systems Center, BMC, and Boole and Baggage.

One of the more broadly based solutions for open systems monitoring is Computer Associates’ CA-Unicenter for UNIX, which established a rules-based system similar to CA’s mainframe products, CA-ACF2 and CA-Top Secret. CA-Unicenter for UNIX facilities include: an automated production control capability for workload scheduling, a restart tool to diagnose failed processes, a report distribution system, spool management functions, a performance monitor that supports system account data in a central data base, a problem management system to open and track problems, and a console management system that can improve upon UNIX’s traditional messaging methods.

A newer company in the industry is 4th Dimension Software, which addresses open systems management products as well as a new Enterprise Control Station for integrating job flow control across data centers and across a number of platforms such as MVS, AS/400, VAX/VMS and UNIX.

Asset management/software inventory management packages are also in demand, particularly those that automatically update changes in the software data base. Some of the leading companies in this area are Computer Associates, IBM, Legent, and Peregrine Systems.

Change management/configuration packages, which track changes in both software and hardware, particularly for remote management, are also increasing in popularity.

The idea of a more fully automated data center management solution continues to be a driving force in the mainframe systems management market.

7. Enterprise-Wide Application Solutions

Enterprise-wide application solutions—based on distributed, network-based connectivity—should be a major new business area for both applications software vendors and systems software vendors in the second half of the 1990s.

However, standard interface issues need to be resolved, and optimal technologies for reducing the cost and increasing the reliability of such applications are still in the emerging stage.

The independent applications software products vendor could be at a disadvantage in providing such products, because they will require very sophisticated application development tools to cost-effectively create the customized type of solutions that will be required for each corporation.

The computer systems and application development tools product companies are in a strong position to provide such products. However, it is in the best interest of all vendors that address application development to create partnerships of companies that work together to provide key modules for enterprise-wide applications.

Oracle's Industries program is one such example, in which Oracle is cooperating with VARs that have expertise in the vertical markets they are addressing.

In general, independent applications software products companies should concentrate their resources more on R&D, and resell through the major computer systems companies, application development tool companies, or through VARs who address smaller business environments. Computer systems vendors should be able to leverage their sales and services organizations through providing a greater breadth of product from third-party providers. Computer systems vendors should also act as VARs, where they receive a portion of the revenues from the third-party supplier, not just reference sale the application product.

8. Positives and Negatives about Rightsizing

There is considerable controversy about the proper approaches to and rewards from an investment in rightsizing.

The origins of rightsizing include the downsizing from higher-cost (per MIP) computers to lower-cost platforms and the upsizing from standalone PCs to LANs and LAN-interconnectivity. The LAN and inter-LAN phenomenon is enhanced by the development of client/server-based solutions, and the spread of relational data bases that allow corporate decision makers greater access to key corporate data on a more timely basis.

A principal controversy surrounding rightsizing is that it hasn't seemed to significantly reduce overall computing costs and has also created additional concerns about corporate data integrity.

Pressure for migration from the mainframe has much to do with the declining cost per MIPS of frequently equivalent processing power on lower-cost platforms, such as minicomputers and workstations. In addition, traditional software pricing has been tied to the cost of the hardware, leading to the users' conclusion that lower costs would follow if systems and applications software were placed on the lower-cost platforms.

Studies conducted by INPUT over the past year do indicate that software costs could be meaningfully reduced by users following a downsizing strategy.

Principal cost problems are associated with the need to retrain developers to work with multiple platforms, networking cost increases, and an increase in the end-user training and services costs.

There is more consensus now that a hurried approach to rightsizing should be avoided, and that the mainframe continues to have valuable attributes in an enterprise-wide interconnected computing environment.

INPUT investigations have indicated that some mainframe prices (as measured by cost per MIPS) have come down to the \$40,000 to \$60,000/MIPS level, getting closer to the \$10,000/MIPS level for some mid-range platforms.

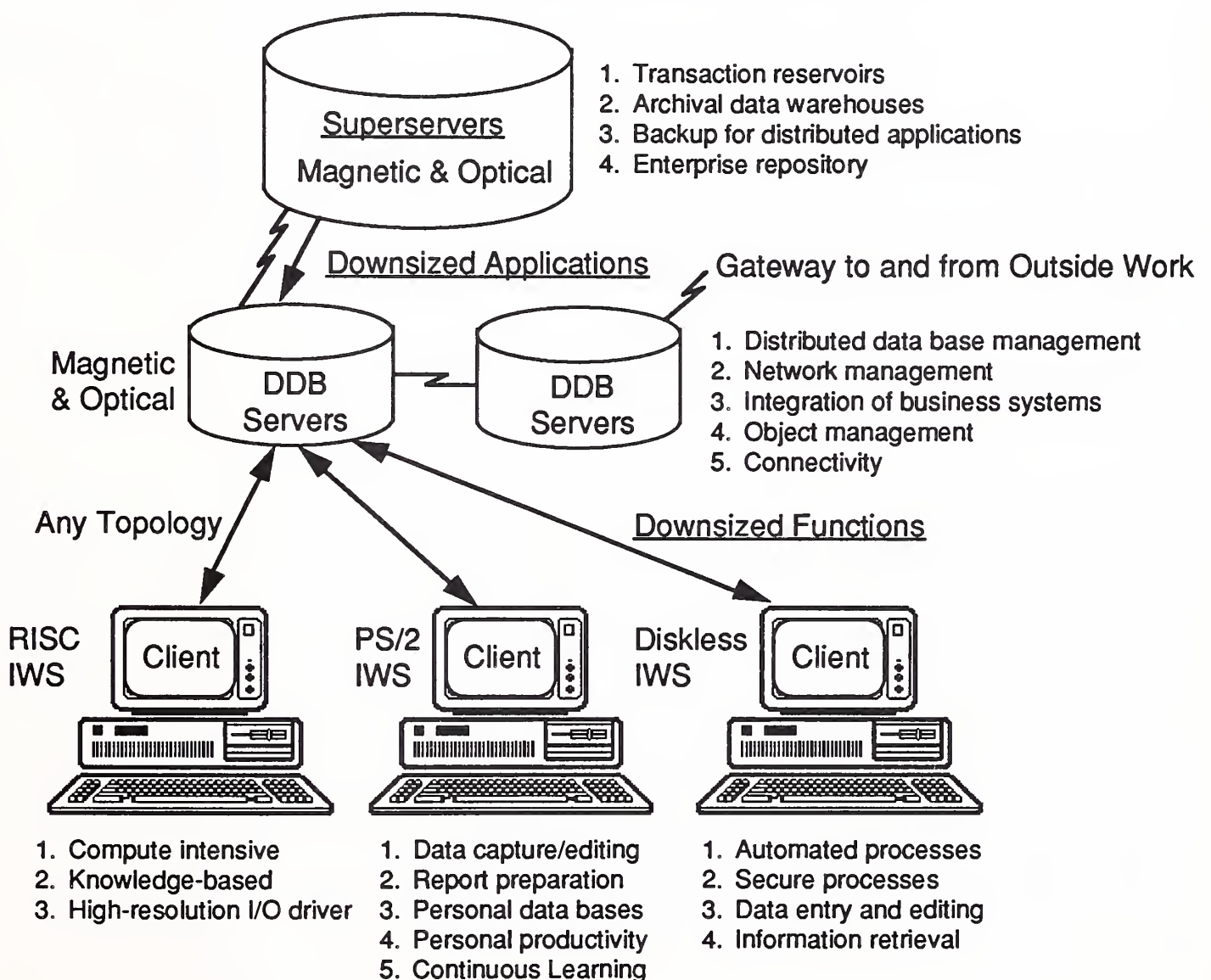
Eventually mainframe and minicomputer definitions may merge, with the MIPS cost differentiation between the systems gradually disappearing. The cost of manufacturing the systems could also decrease significantly with the increased use of CMOS semiconductor technology. This suggests that the valuable attributes of these sophisticated architectures can be

salvaged by improving the quality of the distributed processing solutions with their advanced utilities and systems management features. These machines are likely to find life extension as more specialized application and data base servers.

Exhibit IV-9 states INPUT's view of the proper distributed network architecture for the rightsized world of the 1990s.

EXHIBIT IV-9

Distributed Network Architecture of the 1990s

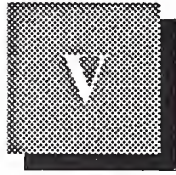


9. Software Pricing Issues in an Enterprise Environment

There is significant pressure by user groups for software vendors to adjust their product and licensing prices to reflect the lower cost of computers in a distributed, lower-cost platform environment. This has led to a number of vendor pricing alternatives offering a great deal of pricing flexibility.

Some of the more common changes have been to: user-based metered pricing versus per machine and tiered pricing; pricing based on aggregated MIPs across multiple sites; upgrade savings plans that allow a program to be moved to larger models without incurring traditional upgrade charges; residual value credits for licenses to help clients move to distributed systems; fixed maintenance rates; enterprise-wide rates; and longer-term flat fee contracts, among others.

An important consideration for vendors is to retain their client base as it migrates to new platforms in a rightsized environment. Flexible pricing alternatives can be important to maintaining the customer base. Also, software vendors should put more emphasis on providing professional services to traditional software clients, to offset lower prices and margins on standards software product and also to be included in customers' longer-term software development product strategies.



Competition

A

Overview

There has been considerable consolidation in the systems software industry in recent years. This has been particularly true in the operations/system management market, with companies such as Computer Associates, Legent and Sterling Software utilizing acquisitions to diversify product offerings and to accelerate revenue growth.

Computer Associates has been particularly successful in its acquisition program, and although Legent has experienced some temporary problems in consolidating recent acquisitions, it too has benefitted from an expansion in product choices for additional platforms.

In the systems control area, the major systems software battle of the decade is shaping up between Microsoft's Windows NT and follow-on, object-oriented Cairo operating system against Novell's NetWare/UnixWare and the UNIX group of operating systems. There will not be any clear winners, but one aspect of the competition is that it has accelerated the development of partnerships within the industry, particularly among UNIX-based computer systems vendors. This is most evident in the development of COSE, with the agenda of creating portability between the two major UNIX factions, USL and OSF.

Enhanced competition can be expected to be a plus for customers, in that enhanced connectivity and portability of applications will result, thus lowering the overall cost of software products. In addition, this new competition in the operating systems software market should lead to lower prices.

Although customer demand will ultimately be the deciding factor as to which operating systems garner increased market share, the issue of "open systems" preferences voiced today by many user and vendor groups will also shape the competitive outcome. Open systems has a number of definitions, as has been indicated earlier in this report. At least from the

vendor's perspective it can have a rather unique interpretation in the competitive environment mentioned above. Among the UNIX and Novell networking operating systems partnerships, openness appears to represent sharing of various systems software elements, which, when developed through common interfaces, provide for interoperability and the opportunity for the various partners to enhance revenues through providing additional elements of functionality.

With Microsoft, technology sharing with partners appears to be more of a one-way relationship. Systems software vendors can contribute code to Windows NT, but the code must be integrated by Microsoft, to maintain the homogeneity of Windows NT. Computer systems companies can benefit by reselling the Windows NT product, but there will be a question of its value if a number of computer systems companies bundle Windows NT with their total systems offering. Some computer manufacturers will save considerable R&D dollars by not developing and maintaining an operating systems software product. However, systems vendors will have to get more value added from consulting, application development, and implementation services to help offset declines in potential revenue sources in operating systems software.

There is likely to be a significant shakeout in the application development tools and data base management systems vendor industry over the next few years. In particular, many younger companies that initially pioneered the tool markets, with emphasis on Windows-based programming interfaces, are going to face considerable competition from 4GL and integrated CASE companies which incorporate object-oriented technology into enterprise-wide development tools.

The systems software companies, in general, should outperform the applications industry by utilizing their application development tools to provide total solutions to their clients, as Oracle has done in its Oracle Industries model. In addition, the computer systems companies are in a good position to garner more applications development business if they use their combined systems software strengths to migrate their customer bases to the new generation of distributed processing. They should also look to establishing partnerships with the leading independent application software products companies to provide them a larger sales and service organization, which leverages the resources of both partners.

Strategic partnering will continue to be a major factor in the systems software products industry, with some new twists: more partnering on standard interfaces, and more partnership between systems software and applications software products companies.

B**Company Profiles**

The following profiles are selected independent systems software companies, which INPUT believes are positioned to perform well over the next several years. There continue to be opportunities for newer companies in the systems software market, but they should address niche market opportunities and/or partnerships with the larger companies.

INPUT provides an additional program offering the Vendor Analysis Program (VAP) which includes coverage on a wide size range of software companies.

1. Candle
2. Computer Associates
3. Compuware Corporation
4. SAS Institute

INPUT provides an additional program offering, the Vendor Analysis Program (VAP), which includes coverage on a wide range of software companies.

1. Candle Corporation

1999 Bundy Drive
Los Angeles, CA 90025
(310) 207-1400
Aubrey Chernick, Chairman and CEO
Merritt Lutz, President and COO
Private Corporation
Total Revenue, Fiscal Year End
12/31/91: \$168,800,000

a. The Company

Candle Corporation is a leading independent developer and supplier of systems management software for IBM mainframe environments, including MVS, CICS, DB2, VM, IMS, CICS/VSE, and VTAM.

- The company was founded in 1977 by Chairman and CEO Aubrey Chernick, developer of OMEGAMON® for MVS, the first performance monitor for IBM's MVS operating system. Since then, Candle has developed a complete line of products for systems automation, status management, application integration, and data base management.

- Candle's systems software products are currently installed in over 7,000 data centers in over 30 countries worldwide.

In 1991, Candle became an initial member of the IBM International Alliance for SystemView. As a result of this partnership, Candle plays a critical role in planning, developing, and marketing SystemView solutions with IBM. Candle is also working closely with IBM to extend the benefits of SystemView to the AS/400 arena.

Also during 1991, Candle unveiled its Candle Technologies™ (CT™), an object-oriented, open systems development technology for distributed processing. CT will be used as the foundation for Candle's future product development.

Candle's 1991 revenue reached \$168.8 million, a 12% increase over 1990 revenue of \$151.4 million.

Candle management attributes growth to new product offerings and the IBM SystemView relationship.

Candle's primary competitors include Boole & Babbage, LEGENT, Platinum, and BMS Software.

b. Key Products and Services

Virtually all of Candle's 1991 revenue was derived from software products and associated maintenance services.

Candle's systems software products are summarized in the exhibit. OMEGAMON, the company's first product, is a real-time system monitoring package that searches for hardware or software problems.

- OMEGAMON performance monitors are currently available for MVS, IMS, CICS, DB2, VM, VSE, and VTAM operating systems and subsystems. There are over 14,000 OMEGAMON licenses worldwide.

The OMEGAMON II series for MVS, IMS, DB2, VTAM, and CICS/ESA are designed for multiple users in the data center. Information is presented using status indicators through CUA-compliant screens.

OMEGACENTER™, introduced in 1989, is an integrated, enterprise-wide software system for data center management. The system is designed to simplify performance management through early detection of problems, in-depth analysis, automation, and remote control. OMEGACENTER includes: OMEGAVIEW® for displaying system conditions and status for MVS, CICS, IMS, DB2, VM, and VTAM operating systems; OMEGAMON performance monitors for real-time analysis; AF/PERFORMER, for automated performance management; AF/OPERATOR, for automated operations; and AF/REMOTE, for remote access and control.

Candle's data base management tools, acquired in early 1990, offer support for the consistent management of the entire DB2 life cycle—from design and development through implementation, administration, management and change.

c. Industry Markets

Candle's revenue is derived from across industry sectors.

More than 80% of the Fortune 500 companies use Candle products.

d. Geographic Markets

Candle's products are licensed extensively in the U.S. and in over 30 countries worldwide.

- In addition to headquarters in Los Angeles, U.S. offices are located in Atlanta (GA); Boston (MA); Oakbrook (IL); Cincinnati (OH); Dallas and Houston (TX); Detroit (MI); Larkspur, Irvine, and Marina del Rey (CA); McLean (VA); New York City and White Plains (NY); and Tampa (FL).

Candle sells products worldwide, with a network of agents in 12 other countries to provide complete coverage across Europe, South America, Asia, and the Middle East.

- International offices are located in the U.K., Austria, France, Germany, Norway, Sweden, Switzerland, the Netherlands, Hong Kong, Singapore, Malaysia, Australia, New Zealand, and Japan.
- International distributors are located in Argentina, Brazil, Israel, Italy, Korea, Mexico, Portugal, Saudi Arabia, Spain, Taiwan, Turkey, and Venezuela.

2. Computer Associates International, Inc.

One Computer Associates Plaza
Islandia, NY 11788-7000
Phone: (516) 342-5224
Fax: (516) 342-5329
Chairman & CEO: Charles B. Wang
Status: Public Corporation
Total Revenue: \$1,841,008,000
Fiscal Year End: 3/31/93

a. Key Points

- Computer Associates International (CA) is the world's leading independent software provider of systems management, data base management, application development, and business application software.
- In 1993, financial results for the year were better than projected, reflecting a turnaround in CA's relationship with its corporate customers.
- Financial results for 1993 indicate that the erosion CA was facing in its mainframe business has been reversed and new sales are now being realized from the existing client base.
- With acquisition of Nantucket's Clipper data base product, CA gained an installed customer base estimated at 500,000. CA also has revealed development plans for the Clipper product line, quelling third-party developer fears.
- In February 1993, CA announced reorganization plans for its personal computer software sales department to prepare for a major promotion of its CA-UNICENTER product line directed at the microcomputer market.
- Over 90% of the Fortune and Forbes 500 companies use Computer Associates software.

b. Company Description

Computer Associates was incorporated in 1974 and commenced operations in 1976. As a result of ongoing internal development and numerous acquisitions, the company currently markets and supports more than 300 systems and application software products worldwide.

CA's product line includes systems management, data base management, application development, and business applications software for use on mainframe, midrange, and desktop computers. The company serves business, government, scientific, and educational organizations through direct operations in 26 countries.

c. Strategy

CA's strategy is to provide its clients with corporate-wide software solutions through internal development, technology acquisition, and extensive product integration. As part of this strategy, in April 1990 CA announced that all of its product development would be in conformance with CA90s: Computing Architecture for the 1990s.

This layered architecture is the blueprint for the continuing development of all CA software, which enables clients to select the hardware platform of their choice, or even a combination of hardware platforms, based upon their distributed or cooperative processing requirements. As a result the company is able to provide enterprise-wide solutions.

Though CA's mainframe business currently accounts for approximately 75% of sales, CA's president Charles Wang has been quoted in the computer industry press describing CA's target revenue mix in the next five years. This revenue mix would be 25% mainframe product revenues, 25% personal computer, 25% UNIX, and 25% other environments.

CA continues to follow an aggressive acquisition growth strategy to build its product offerings.

d. Operations/ Structure

In North America, CA's sales and support personnel are currently organized into two groups: the North American Group and the Third Party Sales Group. The North American Group is responsible for sales, marketing, and service of products sold directly to the end-user and the Third Party Sales Group is responsible for sales, marketing, and service of CA's software products through third-party authorized vendors.

CA operates approximately 60 offices throughout the U.S. in addition to its headquarters in Islandia, New York.

Outside North America, CA operates through wholly owned subsidiaries located in 26 countries and operates over 70 foreign office facilities outside the U.S. Principal offices are located in Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Holland, Hong Kong, Ireland, Israel, Italy, Japan, Korea, Malaysia, New Zealand, Norway, the Philippines, Portugal, Scotland, Singapore, Spain, Sweden, Switzerland, Taiwan, and the U.K.

e. Acquisitions/ Divestitures

Since 1982, CA has completed over 20 acquisitions, as summarized in Exhibit A following this section. With the exception of the Cullinet, UCCEL, and Capex acquisitions, which were accounted for on a pooling of interests basis, all of CA's acquisitions have been purchased. Recent acquisition activity includes the following:

- In September 1992, Computer Associates announced the acquisition of the assets of Glockenspiel Ltd. in Dublin, Ireland. With this acquisition CA entered the C++ market. CA immediately announced plans to embed Glockenspiel CommonView class library technology in CA's "Aspen" project to provide portable application development across Windows, OS/2, and Motif. Aspen is CA's working name for a project designed to develop an object-oriented, GUI-based, high performance compiler for CA-Clipper, CA-dBFast and other xBase languages.
- CA announced in June 1992 the acquisition of privately-held Nantucket Corporation, a leading developer of dBase/xBase-compatible application development systems. The acquisition significantly strengthens CA's position in the PC data base market.

In May 1991, CA combined its INFOPOINT banking software product line with the business of the Newtrend Group in a joint venture that is owned in equal shares by CA and the Newtrend Group. Newtrend continues to be privately held.

f. Alliances

In 1992 and 1993 CA announced several important strategic alliances.

- In March 1993, CA announced a technology and marketing partnership with Cheyenne Software which will allow CA to utilize Cheyenne device drivers technology to allow CA90s customers access to alternative backup media.
- In March 1993, CA and NCR announced a strategic alliance to provide CA's CA-UNICENTER systems management solution for NCR's System 3000 platforms running the UNIX System V.4 operating system. This alliance allows CA to develop applications for NCR platforms. CA and NCR will conduct joint marketing and sales.
- CA announced an alliance in January 1993 with Data General Corporation to provide CA's suite of systems management, business applications, and information management solutions on Data General's AViiion servers under UNIX.

- In September 1992, CA announced a strategic alliance with Sun Microsystems to provide CA-UNICENTER systems management solution for Sun's SPARCserver and SPARCstation families of products.
- In August 1992, CA announced a key strategic alliance with Novell, Inc. under which CA will port its mainframe and midrange systems software to the NetWare network computing environment.

g. Employees

As of April 30, 1993, CA has approximately 7,400 employees, of which 1,093 were located at its headquarters in Islandia (NY), 3,851 at other offices in the U.S., and 2,456 at offices internationally.

Employees in the U.S. are segmented by functional area as follows:

Sales and support	1,750
Product development	700
Other	<u>2,250</u>
Total:	4,700

h. Key Products and Services

Approximately 64% of CA's total fiscal 1993 revenue was derived from software product licenses and 36% from associated maintenance and professional services.

CA's software products are organized into four categories:

Systems Management Software

Systems Management Software supports automated data center operations. Products are available for AS/400, MVS/VSE/VM, VAX VMS, and IBM PC and compatible operating environments. These products are organized into functional areas and support total data center automation. Functional areas supported address the following:

- Automated Production Control, including products such as CA-7, CA-11, CA-SCHEDULER and CA-OPERA
- Data Center Administration, including products such as CA-NETMAN
- Conversion, including CA-CONVERTOR
- Performance Management and Accounting, including products such as CA-JARS, CA-PMA/ChargeBack, and CA-FASTDASD
- Security, Control and Audit, including products such as CA-ACF2 and CA-TOP SECRET, and CA-EXAMINE.

- Automated Storage Management, including products such as CA-I, CA-DYNAM, CA-ASM2, CA-ARCHIVER and CA-SORT
- COBOL Development Environment, including CA-OPTIMIZER and CA-MetaCOBOL+

Information Management Software

Information Management Software improves productivity by integrating relational data bases, repository services, integrated CASE tools, and application generators.

- Information Management Software is available for MVS/VSE/VM, VAX VMS, UNIX, Unisys, and IBM PC and compatible operating environments
- The Information Management portfolio includes data base management systems such as CA-DATACOM, CA-IDMS, and CA-DB.
- Relational data base software CA-CLIPPER and CA-dBFast and CA-Visual Objects an object oriented database development tool.

Business Applications Software

Business Applications Software addresses both vertical and horizontal markets and includes the following areas:

- Financial management software (MASTERPIECE Series) is available for MVS/VSE, S/38, S/36, AS/400, VAX VMS, Unisys, and Data General operating environments. Micro accounting products are also available for PC-DOS, Microsoft Windows, and Macintosh environments.
- Specialized accounting software is available for MVS/VSE, S/38, AS/400, Unisys, and VAX VMS operating environments.
- Human resources management software is available for MVS/VSE/VM, VSAM, IMS; Wang; UNIX; and IBM PC and compatible operating environments.
- Manufacturing and financial management software includes components that address both manufacturing and financial management functions for discrete, repetitive, and aerospace and defense manufacturing. Products are available for AS/400, MVS/VSE/VM and IBM PC and compatible environments.
- Distribution management software is available for VAX VMS environments.

- Business decision and financial management software is available for MVS/VSE/VM, VAX VMS and PC-DOS environments.
- Visual information software is available for MVS/VSE/VM, VAX VMS, PC-DOS, and Macintosh environments, as well as HP, Sun, Data General, Prime, Control Data, and other systems.

Desktop Software

Desktop Software includes accounting software for IBM and Macintosh personal computers (ACCPAC); project management for PC-DOS and VAX/VMS (CA-SuperProject); graphics software for the Macintosh and PC-DOS (CA-Cricket), decision support software for PC-DOS environments, and desktop resource management for PC-DOS and VAX/VMS (CA-NETMAN).

Professional Services

Professional services provided by CA include custom software development, consulting, and education and training.

i. Competition

Competitors include:

Hardware companies supplying systems software such as DEC, Hewlett-Packard, and IBM.

Software companies supplying application software products including Microsoft, Borland, and Dun & Bradstreet Software.

j. Industry Markets

CA's products are used by clients in manufacturing, banking, insurance, retailing, and education, as well as government agencies. More than 90% of the Fortune 500 largest U.S. industrial corporations use one or more of CA's software packages.

In the area of data base management systems, graphics, and applications software for the micro, mini, and mainframe computer, the customer base ranges from small business users to Fortune 500 companies.

k. Geographic Markets

Approximately 46% of CA's fiscal 1993 revenue was derived from the U.S. and 53% from international sources.

3. Compuware Corporation

31440 Northwestern Highway
Farmington Hills, MI 48334-2564
Phone: (313) 737-7300
Fax: (313) 737-7108
Chairman & CEO: Peter Karmanos, Jr.
Status: Public Corporation
Total Revenue: \$235,000,000
Fiscal Year End: 3/31/93

a. Key Points

- In November 1992, Compuware issued a preliminary prospectus in anticipation of its first public offering of its common stock. Prior to the offering, Compuware was one of the largest privately-owned information services companies in the world and one of the largest independent systems software vendors.
- Compuware has expanded its systems software business over the past several years with acquisitions, including the 1991 acquisition of XA Systems Corp., a \$25 million provider of mainframe file and data management tools.
- In October 1992, Compuware announced its intention to acquire the Eyewitness product line from Landmark Systems, substantially strengthening Compuware's fault diagnosis product line.
- Compuware has positioned itself to meet the needs of a growing European customer base. European sales have achieved a compound growth rate of approximately 35% per year, representing nearly one-fourth of Compuware's worldwide product revenues.

b. Company Description

Compuware, founded in 1973, provides systems software products and professional services through two divisions as follows:

- The Products Division, with over 700 employees, provides programmer productivity tools for automated testing, interactive debugging, fault diagnosis, and file and data management. As of September 30, 1992, the company had licensed approximately 37,000 copies of its products to over 5,600 customers worldwide. This division contributed about 75% to Compuware's fiscal 1992 revenue.

- The Services Division, with 716 employees, primarily provides large-scale applications systems development and support to a range of industries, including financial services, manufacturing, higher education, and insurance. This division, with over 100 clients, contributed about 25% to Compuware's fiscal 1992 revenue. In November 1992, Compuware issued a prospectus in anticipation of an initial public offering of 7.3 million shares of its common stock.
- Of the shares to be offered, about 5.5 million are being offered by Compuware and 1.8 million by selling shareholders.
- Net proceeds to Compuware from the sale, estimated to be \$91.7 million, will be used to repay debt, for acquisitions (including the Eyewitness product line), and for general corporate purposes.

c. Strategy

Compuware's strategy for its systems software products is to enhance its leadership position in the market for programmer productivity products by:

- Continuing to focus on the run-time environment
- Pursuing selected acquisitions
- Expanding the functionality of existing products (including expanded support for data base environments such as DB2) and developing new run-time testing and debugging products
- Developing products for new computing environments
- Expanding international markets, including Japan, Europe, South Korea, and Latin America
- Further developing Compuware's installed customer base

Compuware's core strategy for its professional services is to build quality, long-term, profitable relationships with large users of data processing systems. Key elements of this strategy include:

- Focusing on large-scale professional services contracts
- Pursuing growth in existing and new geographical markets while maintaining a high level of personnel utilization
- Taking advantage of the outsourcing trend
- Leveraging technical and industry expertise of Compuware staff

d. Acquisitions

In October 1992, Compuware signed a letter of intent to acquire the Eyewitness fault diagnosis product line from Landmark Systems Corporation for \$12.4 million.

In July 1991, Compuware acquired XA Systems Corp. of Los Gatos (CA) for about \$36 million. The acquisition was accounted for as a purchase.

- XA Systems provided mainframe-based systems software products for file and data management and interactive analysis and debugging.
- XA Systems had revenue of \$25.8 million and a net loss of \$237,000 for the fiscal year ending March 31, 1991.
- The operations of XA Systems have been merged into Compuware's Products Division.

In April 1991, Compuware purchased all rights to the File-AID family of file and data management products for \$18 million from a private party (Joseph R. Blank).

In November 1990, Compuware acquired Innovative Staffing, Inc., a professional services firm based in Columbus (OH).

In July 1990, Compuware acquired Centura Software, Inc. of San Jose (CA), for approximately 2.8 million shares of Compuware common stock. The acquisition was accounted for as a pooling of interests.

- Centura developed, marketed, and maintained the XPEDITER family of interactive debugging products.
- Centura had revenue of about \$12.9 million and net losses of \$1.7 million for the year ending March 31, 1990.

e. Alliances/Joint Ventures

Compuware is an IBM Business Partner—Authorized Application Specialist and an IBM AD/Cycle Vendor Associate Member.

In September 1992, Compuware announced a joint development agreement with PRAGMA Incorporated, an expert in client/server technologies. Compuware will work with PRAGMA to develop products for OS/2 client/server environments that are similar in functionality to Compuware's data base management offerings.

f. Employees

As of September 30, 1992, Compuware had 1,627 employees, segmented as follows:

Sales, sales support, and marketing	377
Research and development	148
Product maintenance and customer support	111
Professional services	683
General and administrative	<u>308</u>
	1,627

The company currently has approximately 1,700 employees.

g. Competitors

Systems software competitors include BMC Software, Computer Associates, Landmark Systems, PLATINUM Technology, Inc., and VIASOFT, Inc.

Professional services competitors include Andersen Consulting, Electronic Data Systems, IBM, and numerous small regional and local firms in the markets in which Compuware has professional services offices.

h. Key Products and Services*Products Division:*

Compuware offers a full line of programmer productivity tools for automated testing, interactive debugging, fault diagnosis, and file and data management in DB2, IMS, TSO/MVS, CICS, and PC operating environments.

- Compuware's flagship product, Abend-AID, is now in use at more than 3,650 IBM mainframe sites worldwide.
- The division currently has more than 5,600 customers worldwide and Compuware products are installed in more than 1,700 sites in Europe alone.

Current Compuware products include the following:

- File and Data Management:
 - File-AID for MVS
 - File-AID for IMS
 - File-AID for DB2
 - File-AID/PC
 - TransRELATE Workbench for DB2

- Fault Diagnosis:
 - MVS Abend-AID
 - MVS Abend-AID for DB2
 - MVS Abend-AID for IMS
 - MVS Abend-AID for IDMS
 - MVS CICS Abend-AID
 - MVS CICS Abend-AID for DB2
 - MVS CICS RADAR
 - VSE Abend-AID
 - VSE CICS Abend-AID
- Interactive Analysis and Debugging:
 - MVS XPEDITER/TSO
 - MVS XPEDITER/IMS
 - MVS XPEDITER/CICS
 - MVS XPEDITER/DB2
 - VSE Xpediter/CICS
 - PATHVU
 - PATHVU/Interactive
 - PATHVU/2
 - Retrofit
- Automated Testing:
 - MVS PLAYBACK
 - File Extension for VSAM
 - File Extension for DB2
 - MVS SIMULCAST
 - VSE Playback

Subscribers to Compuware's maintenance and support services receive technical support and advice, including problem resolution services and assistance in product installation, error corrections, and any product enhancements released by Compuware during the maintenance period.

- These services are provided primarily 24 hours a day, seven days a week by telephone access to technical personnel located in Farmington Hills (MI), Los Gatos (CA), and in the offices of subsidiaries and distributors.
- Perpetual licensees have the option of renewing their maintenance agreements each year for an annual fee of approximately 15% of the then current list price of the licensed product. Perpetual licensees also have the option of purchasing maintenance for up to five years on a prepaid basis.

Services Division:

The Services Division primarily provides large-scale applications systems development, including assisting with requirements definitions, through development of general and detail designs, prototyping, construction, implementation, training, quality assurance, and maintenance support. Services Division capabilities include the following:

- Strategic planning
- Application development and maintenance
- Information engineering
- Project management
- Quality assurance
- Technical support
- Communications and network consulting
- Capacity planning and performance tuning
- Hardware evaluation and selection
- Data management
- Security, disaster prevention, and recovery planning
- Operational reviews
- Conversions
- Training
- System development
- Life cycle development and customization
- Project planning and controls
- Application development platforms and imaging

Typically, the Services Division's professional staff is integrated with the client's development team on a specific application or project.

Compuware prices professional services on a time-and-materials, level-of-effort (fixed number of staff for a fixed time period), or fixed-price project basis.

Professional services staff is reinforced by in-house training programs that provided more than 35,000 hours of technical education during fiscal 1992.

Services Division clients include Comerica, Ford Motor Company, General Motors, Volkswagen United States, Bethlehem Steel, Black & Decker, Warner Lambert, Banc One, Detroit Edison, Borden, E.I. duPont, Whirlpool, the University of Michigan, IBM, National Science Foundation, Fannie Mae, Marriott, and the Johns Hopkins Medical Center.

i. Industry Markets

Compuware's software products are used worldwide by the information systems departments of a variety of business, government, and non-profit organizations.

- Generally, the customers are users of IBM and, to a lesser extent, Amdahl, Fujitsu, and Hitachi mainframe computers.
- Of the approximately 800 companies in the Fortune 1000 who use mainframe computers, approximately 75% license at least one of Compuware's products.

Compuware provides its professional services in the U.S. and Canada to a range of clients, including manufacturers, banks, insurance companies and other financial institutions, educational institutions, and government agencies.

j. Geographic Markets

Approximately 73% of Compuware's fiscal 1992 revenue was derived from North America (including royalty income from European subsidiaries), 21% from European subsidiaries, and 6% from international agents.

Compuware markets its software products through direct sales forces in the U.S., Canada, and Europe and through distributors in 27 other countries.

- Products Division domestic sales offices are in Atlanta (GA), Burlington (MA), Chicago (IL), Dallas (TX), Los Angeles and San Francisco (CA), Malvern (PA), Minneapolis (MN), East Rutherford (NJ), Tampa (FL), and Washington, D.C.
- Software product development centers are in Farmington Hills (MI), Chicago (IL), Los Gatos (CA), and Tokyo (Japan).
- Outside the U.S., the System Software Division has sales offices in Canada, England, France, Germany, Holland, Italy, Denmark, Norway, and Spain.
- Compuware also markets directly or through sales distributors located around the world.

Compuware's Services Division, headquartered in Farmington Hills (MI), also has branches in Baltimore and Bethesda (MD), Colorado Springs (CO), Columbus (OH), Lansing (MI), and Toronto (Canada).

4. SAS Institute, Inc.

SAS Campus Drive
Cary, NC 27513-2414
(919) 677-8000
James H. Goodnight, President
Private Corporation
Total Revenue: \$365,500,000
Fiscal Year End: 12/31/92

SAS Institute, Inc., incorporated in 1976, develops, supports, and maintains systems and applications software products. Their flagship product, the SAS^R System, is an integrated information delivery system for enterprise-wide data access, management, analysis, and presentation. Total 1991 revenue reached \$295.1 million, a 23% increase over 1990 revenue of \$240.2 million. SAS Institute has been profitable since its formation in 1976.

SAS Institute management attributes revenue growth in 1991 to the following:

- Revenue from UNIX-based products increased 170% over 1990. In other environments, revenue from SAS software on mainframes increased about 18%; revenue rose 25% in the PC (DOS and OS/2) arena; and revenue for the SAS System under DEC VMS and RISC/ULTRIX platforms rose 20%.
 - During 1991, SAS Institute released its software for seven new UNIX platforms—DEC's RISC/ULTRIX, IBM's AIX, Apollo's DOMAIN/os, Data General's DG/UX, MIPS' RISC/os, Silicon Graphics' IRIX, and NeXT Computer's NeXTstep.
 - The company further enhanced its UNIX releases to users by adding a new component to the SAS System—SAS/INSIGHT software for graphical data analysis—which was first made available for the UNIX environment. SAS/INSIGHT software has since been made available on other platforms.
- Revenue in the U.S. grew about 18%, while Canadian sales rose 17%. The European division posted a 33% increase, while the Asia/Pacific division had a 28% revenue growth.

Approximately 35% of total revenue was devoted to research and development during 1991.

SAS Institute's principal competitors, by specific application area, include the following:

- Data management: Information Builders' FOCUS
- Graphics: Computer Associates' DISSPLA and TELL-A-GRAF
- Statistical analysis: SPSS
- Data base management systems: Information Builders' FOCUS, On-Line Software International's RAMIS, and Must Software International's NOMAD
- C compiler products: IBM

a. Key Products and Services

SAS derived approximately 90% of its 1991 revenue from software products and related services. Consulting and education services accounted for approximately 10% of revenue.

With more than 3 million users in 105 countries, SAS software products are installed at 23,025 sites. As of January 1992, the total number of installed products, by processor, included:

Mainframes	33,945
Minicomputers (including 15,697 VMS sites)	16,396
UNIX-based workstations	53,000
Microcomputers	545,000

The SAS System includes more than 125 built-in applications groups in modular components. These applications provide capabilities for executive information systems; data entry, retrieval, and management; report writing and graphics; statistical and mathematical analysis; business planning, forecasting, and decision support; operations research and project management; quality improvement; computer performance evaluation; and applications development.

- The SAS System's MultiVendor Architecture™ (MVA™) maximizes the system's ease of migration from one operating environment to another. With MVA, the SAS System is a vendor-independent system that runs similarly across all environments the SAS System supports.

- The SAS System supports mainframes (MVS, CMS, VSE), minicomputers (VMS, AOS/VS, PRIMOS), UNIX workstations (SunOS, HP-UX, AIX, DG/UX, RISC/ULTRIX, RISC/os, DOMAIN/OS, NeXT, IRIX), and personal computers (PC DOS, MS-DOS, OS/2).

SYSTEM 2000 runs on IBM 370, 390, 30XX, 43XX, 93XX, and compatible computers under OS, CMS, DOS/VS, DOS/VSE, and in conjunction with CICS; the Unisys Series 1100 under OS 1100; and the Control Data 6000 and CYBER series under NOS and NOS/BE.

Recent announcements include the following:

- SAS Institute is assisting DEC with the Alpha VMS project, DEC's new 64-bit RISC processors.
- In early 1992, SAS Institute announced its first vertical market software product, SAS/PH-Clinical.
- Also in early 1992, SAS Institute expanded its SAS/ACCESS software family with interfaces for linking the SAS System with Computer Associates' CA-DATACOM/DB, Software AG's ADABAS, IBM's IMS, and ASK's INGRES.
- In January 1992, SAS Institute announced its latest release of the SAS System for Information Delivery (Release 6.07). The new version of the SAS System extends its data access, management, analysis, and presentation capabilities.

The company licenses all software products on an annual basis (with the exception of the JMP family of products). License fees for mainframe and minicomputer products are based on machine classification. Fees for the PC products are based on the number of workstations where the product is installed. Renewals are available at lower rates. Discounts are available to degree-granting institutions.

Technical support, enhancements, and one set of documentation are included in the annual license fee. Users also receive a quarterly news magazine free of charge.

SAS Institute offers a range of instructor, video, and computer-based training, as well as trainers' kits. Instructor training is available at the Institute Training Center in Cary (NC) and at facilities in Austin (TX), Rockville (MD), Chicago (IL), New York City (NY), Irvine (CA), and Toronto. Instruction is also held at customer sites, and hotel and conference centers across the U.S.

b. Industry Markets

SAS Institute's 1991 revenue was derived from clients in all industries, including many Fortune 1000 companies. Approximately 71% of clients are businesses (including 98% of the Fortune 100), 16% are universities, and 13% are government agencies.

Some of SAS Institute's announced customers include Alcoa, Amoco, Avon, BASF, Data General, DEC, Duke University, Exxon, Glaxo, Harvard University, Hewlett-Packard, IBM, MCI, Monsanto, Pfizer, Rolm and Haas, Rolls Royce, Shell Oil, Sun Microsystems, 3M, Upjohn, and the U.S. Bureau of the Census.

c. Geographic Markets

In January 1992, SAS Institute opened a New York City regional office to better address the needs of its customer base in the Northeastern U.S. In addition to New York City, SAS Institute has offices in Cary (NC), Austin (TX), Irvine (CA), Chicago (IL), and Rockville (MD).

SAS Institute operates subsidiaries in Taiwan, Germany, the U.K., Canada, Australia, France, Japan, Italy, Sweden, Denmark, Finland, Norway, Switzerland, Belgium, the Netherlands, Spain, New Zealand, Korea, the Philippines, Singapore, Hong Kong, Malaysia, and China. SAS Institute also has distributors located in Saudi Arabia, Israel, Venezuela, Brazil, Peru, Puerto Rico, Columbia, Uruguay, Turkey, Yugoslavia, Portugal, Greece, Argentina, Chile, Mexico, Thailand, Guatemala, Hungary, Nigeria, Pakistan, and Panama.



Profitability within the Systems Software Industry

There has been a wide spread in profitability among publicly owned systems software companies. A sample of gross margins and net margins for a number of the systems software companies in fiscal 1992 is presented below:

Application Development Tools and Relational Data Base Systems Management Companies

Company	Gross Margin	Net Margin
Bachman Information Sys.	86.9%	6.0%
Cognos, Inc.	89.6%	3.6%
Easel	76.4%	-9.2%
Knowledgeware, Inc.	86.7%	0.2%
Oracle Systems	76.1%	5.2%
Progress Software	84.1%	11.3%
Sybase	82.6%	9.0%

Operations/Systems/ Data Center Management

Companies	Gross Margins	Net Margins
BMC Software, Inc.	88.8%	25.0%
Boole & Babbage	85.4%	5.0%
Cheyenne Software	93.8%	51.0%
Computer Associates	87.4%	10.7%
Systems Control		
Banyan Systems	71.7%	7.0%
Microsoft	83.1%	25.7%
Novell	80.3%	26.7%

The gross margins of software products companies tend to be much higher than in other industries. The low cost of reproducing the product is one of the obvious reasons. There is also only a small part of the research and development costs that is capitalized, and thus depreciation of capital expenses is not usually a significant factor.

However, net margins for many of the companies are quite low, even relative to most other industries. The companies with the higher net margins are those with large indirect sales structures or very efficient direct sales organizations, that benefit from large-volume sales to major enterprises. Reselling through VARs or large systems vendors with large sales and services organizations and distributors should be considered by software companies as a way to substantially improve net margins.

In turn, major systems vendors can leverage their sales and marketing profitability by reselling applications from third-party software developers.



Conclusions and Recommendations

Software products vendors should carefully evaluate the structural changes now occurring in the software markets. In the latter half of the 1990s users have sophisticated needs, and procurement practices will require more complex products and distribution approaches than in prior years. In addition, a significant international marketing presence will be required to maximize product growth potential.

INPUT's surveys of IS budget expenditures continue to indicate that over half of the available software products market is taken by internally developed products. There is also a continuing trend to customized product development with third-party partners. The utilization of third-party partners for application development and integration has become even more compelling in the recent era of rightsizing of corporate IS functions.

The increasing complexity of multi-platform application development and networking is taxing the resources of central IS departments to provide rightsizing solutions that can be justified to senior corporate management in terms of return on investment (ROI).

INPUT's client and vendor surveys over the past year on the impact of computer downsizing/rightsizing suggest that significant cost savings have not been a major benefit to date. The current benefits are largely in the two areas of better decision support from more timely data access, and flexibility of application development from moving application development off the mainframe.

To date, the migration off the mainframe has been slow, even though client/server networking at the departmental level has experienced strong growth in recent years. The mainframe continues to be used, often in a dual architecture context to help insure the continued integrity of distributed data.

The enterprise-level market of internally developed data processing solutions is the largest available market within the information services industry. Success in this market will require emphasis on professional services such as re-engineering consulting, application development tools, and customizable packages. Independent systems software and computer systems vendors possessing strong application tool technology should have a substantial advantage in capturing much of this market.

Oracle Systems has developed one model for addressing this market with its Oracle Industries program, mentioned earlier in this report. This involves the use of industry and VAR partners, particularly with a vertical market emphasis, to develop reusable templates for more rapid application development of customized solutions. It also stresses reusability of solutions through the use of software code repositories, based on its CASE solutions. Oracle and other large software and computer systems vendors have large customer bases which need help in migrating their applications into distributed networks. It is crucial that software vendors capitalize on this potential market opportunity in order to maintain their revenue and profitability momentum in the 1990s.

A major application development opportunity is in building integrated, enterprise-wide applications. There is currently a significant lack of such solutions from applications software products companies. Integration will require support of open systems, partnering between independent applications software vendors and VARs, and use of distributed computing solutions developed through vendor consortiums such as OSF (DCE and DME).

A particular requirement for success in this market is strength in application development tools (particularly object-oriented technology) and support for open systems solutions. Object-oriented technology could ultimately provide the solution for interconnectivity across diverse operating systems and hardware architectures over the longer term. In the near term, the use of object-oriented encapsulation programming techniques is one of the best ways to migrate legacy data bases and applications to distributed platforms, while maintaining the benefits of the legacy systems through strong distributed connectivity solutions. In particular, new solutions are required in systems management/security management products for distributed networks. Until these become available, proprietary systems solutions will continue to have major benefits, while firms rightsize data processing to achieve improved cost and decision support efficiencies.

Object-oriented development tools will be a key factor in reducing the cost of software application development and maintenance, particularly for diverse operating systems and hardware architectures.

Partnering, based on building complementary components of open systems (where the partners benefit from cross-selling revenues) will continue to be very important in achieving a "total systems" posture.

Younger companies, with innovative application development tool technology, look to partnering with large computer systems vendors to leverage sales and marketing capability. This tactic is already evident in recent partnerships among a number of object-oriented data base management systems companies and larger computer manufacturers.

Essentially, the market for many standard software products in the 1990s is maturing, especially in the high price systems category. The major market opportunity will be for customized solutions which deliver improved efficiency in application development and maintenance.

Summaries of INPUT's conclusions and recommendations for systems software vendors in the second half of the 1990s are included below, in Exhibits VII-1 and VII-2.

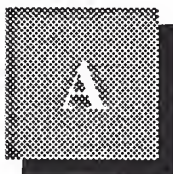
EXHIBIT VII-1**Conclusions**

- Application development and other types of professional services will provide a major market for systems software vendors in the era of rightsizing
- Open systems will provide more cost effective solutions, but potentially lower-margin solutions
- Open-systems products should be enhanced with value-added consulting and other professional services
- Object-oriented technology will be an increasingly important application development tool in a distributed computer environment
- Systems management tools for an open-systems environment will provide a major product opportunity

EXHIBIT VII-2

Recommendations

- Support industry standards and get them implemented
- Form strategic alliances with care
- Develop expertise in object-oriented technology
- Capitalize on migration difficulties of corporate IS by providing total solutions capabilities
- Pursue client/server and open system architectures.
Avoid being "locked in" on a single platform/architecture



Forecast and Data Base Reconciliation

Exhibits A-1 and A-2 offer the 1993-1998 market forecast by submode and platform.

EXHIBIT A-1

Systems Software Products Market Forecast by Submode, 1993-1998

Delivery Mode	1992 (\$M)	Growth 1992- 1993 (%)	1993 (\$M)	1994 (\$M)	1995 (\$M)	1996 (\$M)	1997 (\$M)	1998 (\$M)	CAGR 93-98 (%)
Total	19,825	9	21,702	23,042	24,639	26,513	28,664	31,186	8
<i>Systems Control Products</i>	6,810	5	7,158	7,218	7,325	7,456	7,560	7,660	1
- Mainframe	2,860	-1	2,830	2,688	2,555	2,426	2,305	2,190	-5
- Minicomputer	2,180	6	2,310	2,330	2,350	2,370	2,385	2,400	0
- Workstation/PC	1,770	14	2,018	2,200	2,420	2,660	2,870	3,070	9
<i>Operations Management Tools</i>	4,915	13	5,536	5,874	6,246	6,658	7,116	7,623	7
- Mainframe	2,637	10	2,900	2,987	3,077	3,169	3,264	3,362	3
- Minicomputer	1,634	14	1,863	1,975	2,093	2,219	2,352	2,493	6
- Workstation/PC	644	20	773	912	1,076	1,270	1,500	1,768	18
<i>Applications Development Tools</i>	8,100	11	9,008	9,950	11,068	12,399	13,988	15,903	12
- Mainframe	3,510	5	3,686	3,833	3,987	4,146	4,312	4,485	4
- Minicomputer	2,630	7	2,814	2,982	3,162	3,355	3,553	3,765	6
- Workstation/PC	1,960	28	2,508	3,135	3,919	4,898	6,123	7,653	25

EXHIBIT A-2

Systems Software Products Market Forecast by Platform, 1993-1998

Platform	1992 (\$M)	Growth 1992- 1993 (%)	1993 (\$M)	1994 (\$M)	1995 (\$M)	1996 (\$M)	1997 (\$M)	1998 (\$M)	CAGR 93-98 (%)
Total	19,825	9	21,702	23,042	24,639	26,513	28,664	31,186	8
<i>Mainframe</i>	9,007	5	9,416	9,508	9,619	9,741	9,881	10,037	1
- Systems Control Products	2,860	-1	2,830	2,688	2,555	2,426	2,305	2,190	-5
- Operations Management Tools	2,637	10	2,900	2,987	3,077	3,169	3,264	3,362	3
- Applications Development Tools	3,510	5	3,686	3,833	3,987	4,146	4,312	4,485	4
<i>Minicomputer</i>	6,444	8	6,987	7,287	7,605	7,944	8,290	8,658	4
- Systems Control Products	2,180	6	2,310	2,330	2,350	2,370	2,385	2,400	1
- Operations Management Tools	1,634	14	1,863	1,975	2,093	2,219	2,352	2,493	6
- Applications Development Tools	2,630	7	2,814	2,982	3,162	3,355	3,553	3,765	6
<i>Workstation/PC</i>	4,374	21	5,299	6,247	7,415	8,828	10,493	12,491	19
- Systems Control Products	1,770	14	2,018	2,200	2,420	2,660	2,870	3,070	9
- Operations Management Tools	644	20	773	912	1,076	1,270	1,500	1,768	18
- Applications Development Tools	1,960	28	2,508	3,135	3,919	4,898	6,123	7,653	25

The total markets for 1992 and 1993 have been adjusted downward in INPUT's current forecast.

An adjustment was made in the absolute size of the U.S. systems software market in 1992 to \$19.8 billion, compared to the forecast of \$20.4 billion. This results from recession-influenced sales figures in 1992 and reduced expenditures in the mainframe software sector, while client/server computing manufacturers gained greater acceptance very rapidly.

Exhibits A-3 and A-4 provide INPUT's reconciliation of the 1992 and 1997 U.S. market forecasts by submode and platform as noted in the 1992 Systems Software Product report.

EXHIBIT A-3

Systems Software Products Market Forecast 1993 Data Base Reconciliation by Submode

	1992 Report Forecast (\$M)	1992 Market			1992 Report Forecast (\$M)	1997 Market			92-97 CAGR per data 92 Rpt (%)	92-97 CAGR per data 93 Rpt (%)
		1993 Report (Actual) (\$M)	Variance From 1992 Forecast			1993 Report (Actual) (\$M)	Variance From 1992 Forecast			
			(\$M)	(%)			(\$M)	(%)		
Delivery Mode	20,480	19,825	-655	-3	38,580	28,664	-9,916	-26	14	8
Systems Control Products	7,062	6,810	-252	-4	12,340	7,560	-4,780	-39	12	2
- Mainframe	2,894	2,860	-34	-1	3,604	2,305	-1,299	-3,6	4	-4
- Minicomputer	2,255	2,180	-75	-3	3,632	2,385	-1,247	-34	10	2
- Workstation/PC	1,913	1,770	-143	-7	5,104	2,870	-2,234	-44	22	10
Operations Management Tools	4,820	4,915	95	2	9,260	7,116	-2,144	-23	14	8
- Mainframe	2,573	2,637	64	2	4,690	3,264	-1,426	-3,0	13	4
- Minicomputer	1,593	1,634	41	3	2,637	2,352	-285	-11	11	8
- Workstation/PC	654	644	-10	-2	1,933	1,500	-433	-22	24	18
Applications Development Tools	8,598	8,100	-498	-6	16,980	13,988	-2,992	-18	15	12
- Mainframe	3,770	3,510	-260	-7	6,615	4,312	-2,303	-35	12	4
- Minicomputer	2,818	2,630	-188	-7	5,010	3,553	-1,457	-29	12	6
- Workstation/PC	2,010	1,960	-50	-2	5,355	6,123	768	14	22	26

EXHIBIT A-4

Systems Software Products Market Forecast 1993 Data Base Reconciliation by Platform

	1992 Report Forecast (\$M)	1992 Market			1992 Report Forecast (\$M)	1997 Market			92-97 CAGR per data 92 Rpt (%)	92-97 CAGR per data 93 Rpt (%)
		1993 Report (Actual) (\$M)	Variance From 1992 Forecast			1993 Report (Actual) (\$M)	Variance From 1992 Forecast			
			(\$M)	(%)			(\$M)	(%)		
Platform	20,480	19,825	-655	-3	38,580	28,664	-9,916	-26	14	8
<i>Mainframe</i>	9,237	9,007	-230	-2	14,909	9,881	-5,028	-34	10	2
- Systems	2,894	2,860	-34	-1	3,604	2,305	-1,299	-36	4	-4
Control Products										
- Operations	2,573	2,637	64	2	4,690	3,264	-1,426	-30	13	4
Management Tools										
- Applications	3,770	3,510	-260	-7	6,615	4,312	-2,303	-35	12	4
Development Tools										
<i>Minicomputer</i>		6,666	6,444	-222	-3	11,279	8,290	-2,989	-27	115
- Systems	2,255	2,180	-75	-3	3,632	2,385	-1,247	-34	10	2
Control Products										
- Operations	1,593	1,634	41	3	2,637	2,352	-285	-11	11	8
Management Tools										
- Applications	2,818	2,630	-188	-7	5,010	3,553	-1,457	-29	12	6
Development Tools										
<i>Workstation/PC</i>	4,577	4,374	-203	-4	12,392	10,493	-1,899	-15	22	19
- Systems	1,913	1,770	-143	-7	5,104	2,870	-2,234	-44	22	10
Control Products										
- Operations	654	644	-10	-2	1,933	1,500	-433	-22	24	18
Management Tools										
- Applications	2,010	1,960	-50	-2	5,355	6,123	768	14	22	26
Development Tools										

The 1992 and 1993 market forecast reconciliations noted in Exhibits A-3 and A-4 indicate variances for platform and submode values for the 1992 market ranging from 1% to 7%, with systems control products running 4% below prior forecasts, operations management 2% lower, and applications development tools running 6% lower in the 1992 report.

The figures projected for 1997 in this report (compared to the 1992 report) show significant variances, from 11% to 44%. The variances reflect a major adjustment in INPUT's forecasted outlook for the five-year growth rates for the systems control and operations management software sectors, and sharply reduced mainframe and minicomputer (to a lesser degree) unit shipments over the next five years. This change reflects expectations for significant pricing pressures in these systems software areas, an expected move to open systems solutions, and negative growth rate expectations for mainframe platforms as migration to distributed processing accelerates.

